ORDNANCE

THE MAGAZINE OF SCIENTIFIC AND INDUSTRIAL PREPAREDNESS

VOL. XXXIV, No. 176 • SECTION I • SEPTEMBER-OCTOBER, 1949

FOUNDED 1920

IN THIS ISSUE

GORDON GRAY

From buck private to Secretary of the Army

THE JOURNAL
OF THE AMERICAN
ORDNANCE
ASSOCIATION
WASHINGTON, D. C.

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ORDNANCE

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Magazine of Scientific and Industrial Preparedness

THE JOURNAL OF THE AMERICAN ORDNANCE ASSOCIATION

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• The Honorable Gordon Gray, new Secretary of the Army, whose likeness appears on the front cover of this issue of ORDNANCE, raised his hand to be sworn into his new office on June 20, 1949—just seven years after participating in the somewhat similar but less impressive ceremony of being sworn into the United States Army as a buck private. It could happen only in a democracy!

The 40-year-old Winston-Salem, N. C., lawyer, State senator, and newspaper publisher was formerly Assistant Secretary and later Under Secretary of the Army. During World War II he saw service overseas as an Infantry captain.

More than one hundred Senators, Representatives, Cabinet members, and top military leaders, including General Eisenhower, Acting Chairman of the Joint Chiefs of Staff, were present when Mr. Gray took the oath of office administered by Louis Johnson, Secretary of Defense.

• This issue of ORDNANCE is published in two sections. Section II contains a complete and up-to-date roster of the officials of the national Association, the officers and directors of all the local Posts, and members of the various A.O.A. Technical Divisions and Committees. In the second section there also is published the Honor Roll of Industrial Preparedness which lists the nearly 800 Company Members of the Association who are coöperating in our efforts to effect scientific and industrial preparedness for national security and peace.

—The Editors

A Program To Keep America Strong For Peace

TO KEEP ABREAST of the rapid and far-reaching advances in scientific and technical knowledge and their growing applicability to arms and to industry, the American Ordnance Association is devoting its energies to the following program for national security and peace:

To use all lawful means to ensure that the United States, its Government, Industry, and People

1. Strengthen in every way the close relationship among Science-Industry-Ordnance as indispensable factors of our national security and, to this end, foster close coöperation on the part of the Army, Navy, and Air Force with scientific and educational institutions.

2. Maintain a continuing national program of ordnance research and development, utilizing all facilities—governmental and private—for this purpose.

3. Inaugurate an annual ordnance replacement program to assure latest types of equipment for all our armed forces—ground, sea, and air.

4. Strengthen and increase in time of peace the fourteen decentralized Ordnance Districts.

5. Accumulate and maintain adequate reserves of strategic raw materials to safeguard our national security.

6. Preserve and strengthen our arsenals and depots—ground, sea, and air—to enable them, in coöperation with science and industry, to keep alive the knowledge of ordnance production and logistics in time of peace.

7. Train annually military and civilian personnel of the technical branches of the Military, Naval, and Air Forces in current industrial practices, and, similarly, train key scientific and industrial personnel in the technique of ordnance design, production, and logistics.

8. Establish and maintain Ordnance R.O.T.C. units at qualified educational institutions of our country and substantially increase the number of these units.

9. Educate all our people in the vital importance of planning not only for the mobilization of our national resources but also for their effective utilization wherever needed to keep war out of America.

10. Foster public interest in scientific, industrial, and military preparedness to keep America strong for peace ashore, afloat, and aloft.

A Guaranty of Peace

The American Ordnance Association, founded 1919, is a patriotic, educational, scientific, and nonprofit membership society of American citizens dedicated to scientific and industrial preparedness for the common defense as one of our Nation's strongest guaranties of security and peace.

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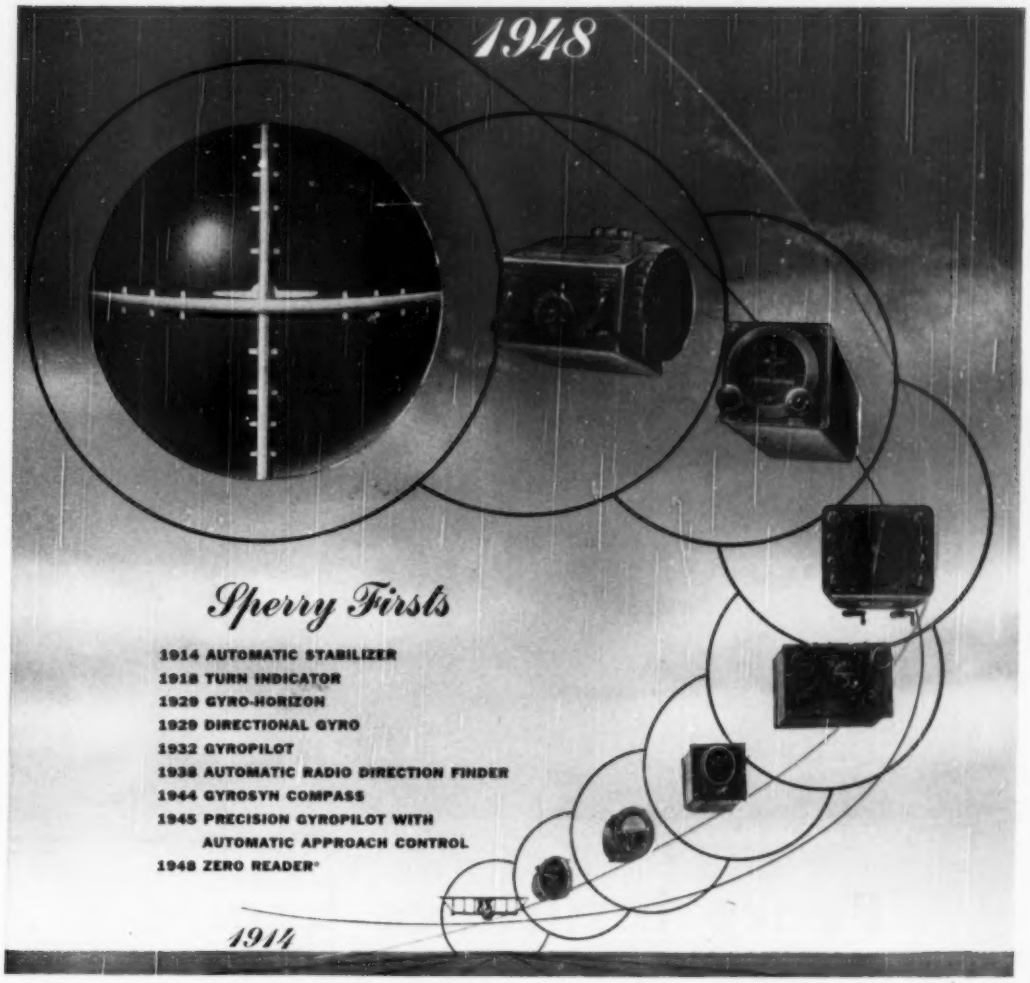

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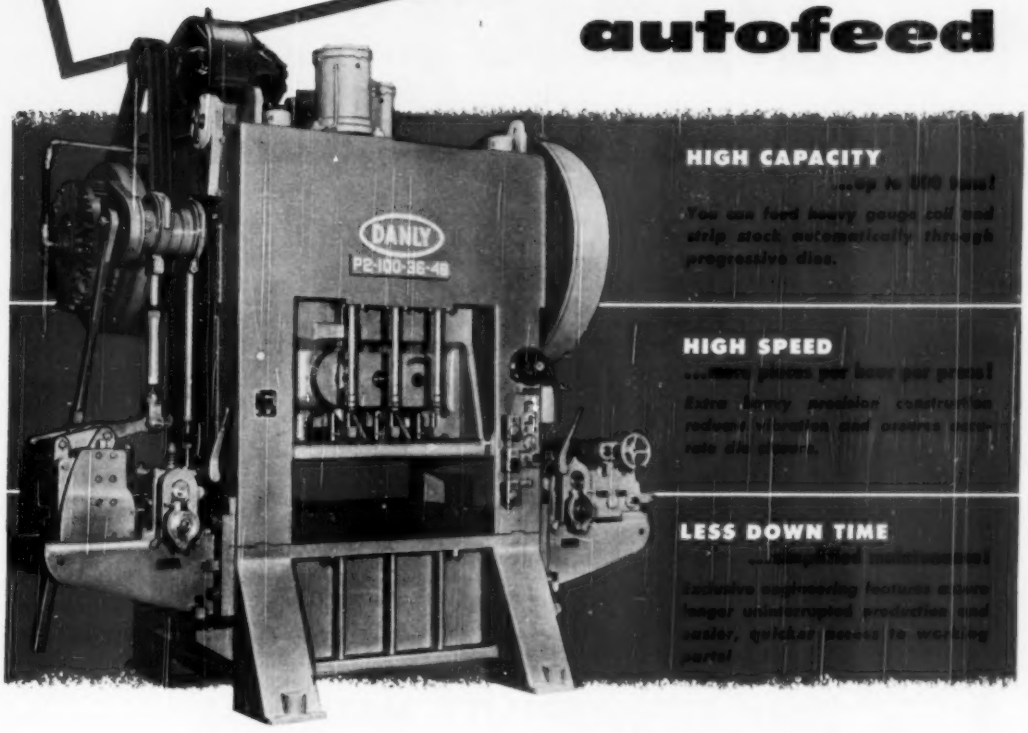
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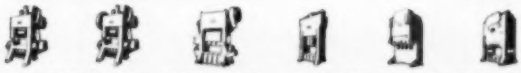

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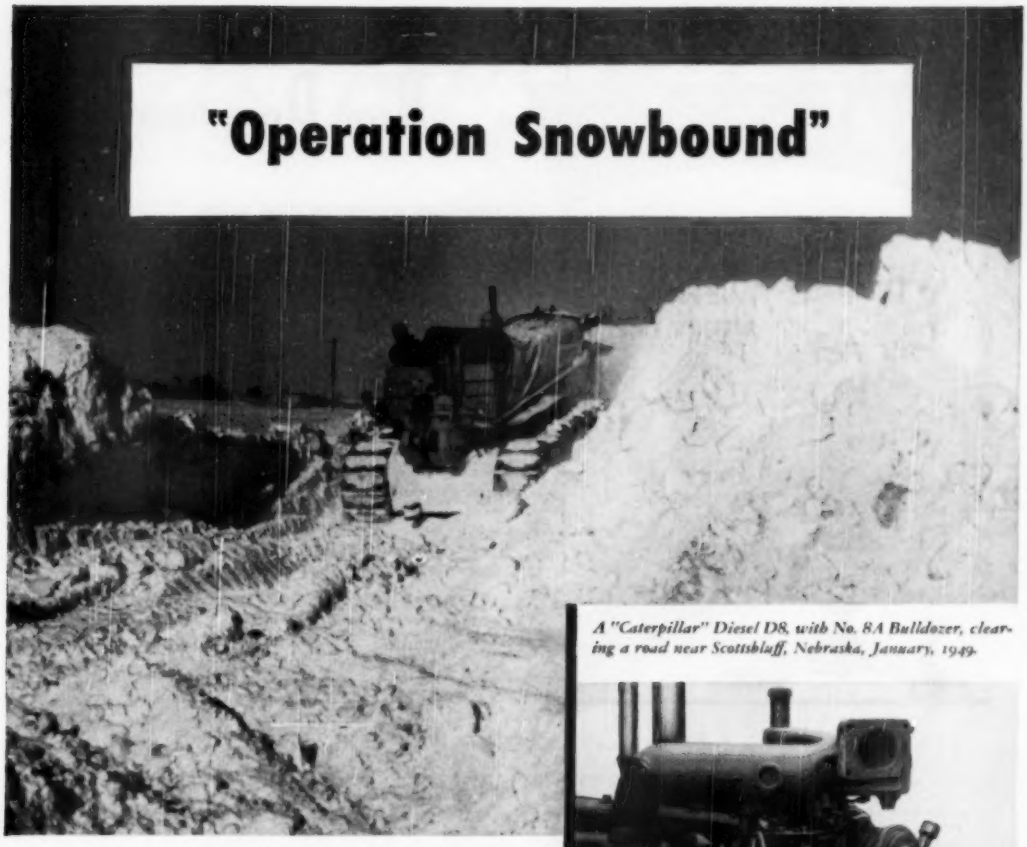


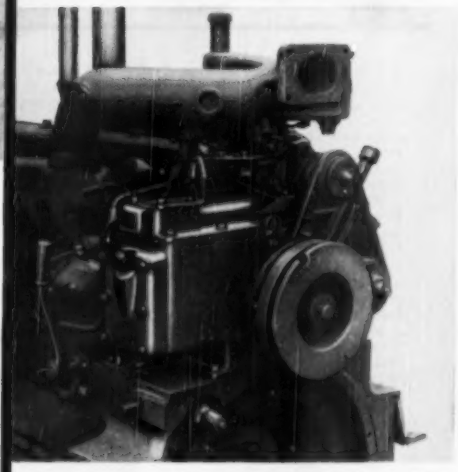
A "Caterpillar" Diesel D8, with No. 8A Bulldozer, clearing a road near Scottsbluff, Nebraska, January, 1949.

THE ARMY won't soon forget the blizzards of last winter—or the valiant work of the many "Caterpillar" Diesel Tractors that 'dozed open drifted roads for rescue missions.

Rugged power, sturdy construction and sure-footed traction kept the D7s and D8s bucking through deep snows hour after hour.

One vitally important feature of the "Caterpillar" Diesel Tractor is its independent gasoline starting engine. Easy to start by hand, this simple, efficient little engine eliminates worries over low battery power in cold weather. It permits conditioning of the big Diesel not for just a minute or two but as long as necessary. Warm water is circulated through the Diesel system and, by turning the Diesel over on compression, the starting engine gets it well warmed up and lubricated before it begins the day's work.

Built to operate at full efficiency in desert heat or arctic cold, these big yellow machines will continue to serve the Armed Forces well both in peace and war.



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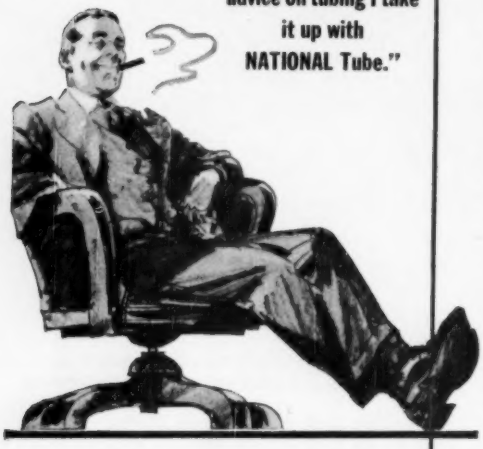

● Life runs smoother for a good many purchasing agents and plant engineers who have made it a habit to get our recommendations on their alloy tubing requirements. Because we have been successfully applying steel tubes to every industry for sixty years we have been able to make sound, practical suggestions in the selection and use of tubing that have saved them money again and again. We can do the same for you.

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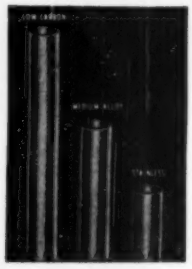

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New Developments

GUIDED MISSILES FOR SUBS

New-type submarines capable of launching guided missiles are now being developed by the Navy, according to Under Secretary of the Navy Dan A. Kimball. Mr. Kimball also said that the new submarines will be equipped to function more closely and effectively with carriers and aircraft.

NEW JET FIGHTER

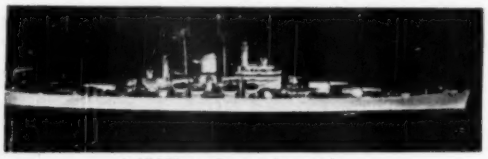
The Air Force's newest jet fighter, the Republic XF-91, is powered by a General Electric J-47 turbojet engine producing more than 5,000 pounds of thrust, and it will also have rocket motors to be used for accelerated take-off and climb and for operation at high altitudes. The swept-back wings of the XF-91 taper inversely and appear wider at the tips than at the fuselage. The aircraft is forty-five feet long and has a wing span of about thirty feet.

ARMY ROCKET RESEARCH

A contract to organize and operate a laboratory for basic research and development in rockets and jet propulsion has been signed with the Ordnance Department of the Army by Rohm & Haas Company of Philadelphia, chemicals manufacturers. The project will be located at the Army's Redstone Arsenal near Huntsville, Ala., one of the large arsenals constructed during the last war. The company will not enter into the manufacture of propellants.

NEW HEAVY CRUISER

The U.S.S. SALEM, third and last of a mighty trio of heavy cruisers, recently joined the fleet. Preceded by the U.S.S. DES MOINES and the U.S.S. NEWPORT NEWS, the SALEM gives its name to the 3-ship class of 17,000-ton cruisers. The vessels, all of which are powered by four 30,000-horsepower propulsion



A 17,000-ton SALEM-class cruiser.

turbines, are the heaviest and most powerful "heavy" cruisers afloat. In the entire cruiser class of capital ships they are outweighed only by the three "battle" cruisers of the ALASKA class which displace 27,500 tons, comparing in size with the German "pocket battleships" SCHARNHORST and GNEISENAU. Announced speed of the SALEM is "30 knots plus," but since some of the older cruisers can make that speed, the SALEM can be expected to log quite a bit more.

Firepower of the cruisers is centered in a main battery of nine 8-inch 55-caliber guns on each ship supported by a secondary battery of twelve 5-inch double-purpose guns and by more than thirty other antiaircraft guns. According to Navy ordnance experts, the 8-inchers can fire four times faster than any previous guns of the same or larger caliber because an electrically operated loading system, fully automatic from han-

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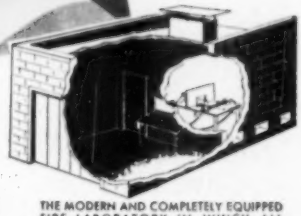

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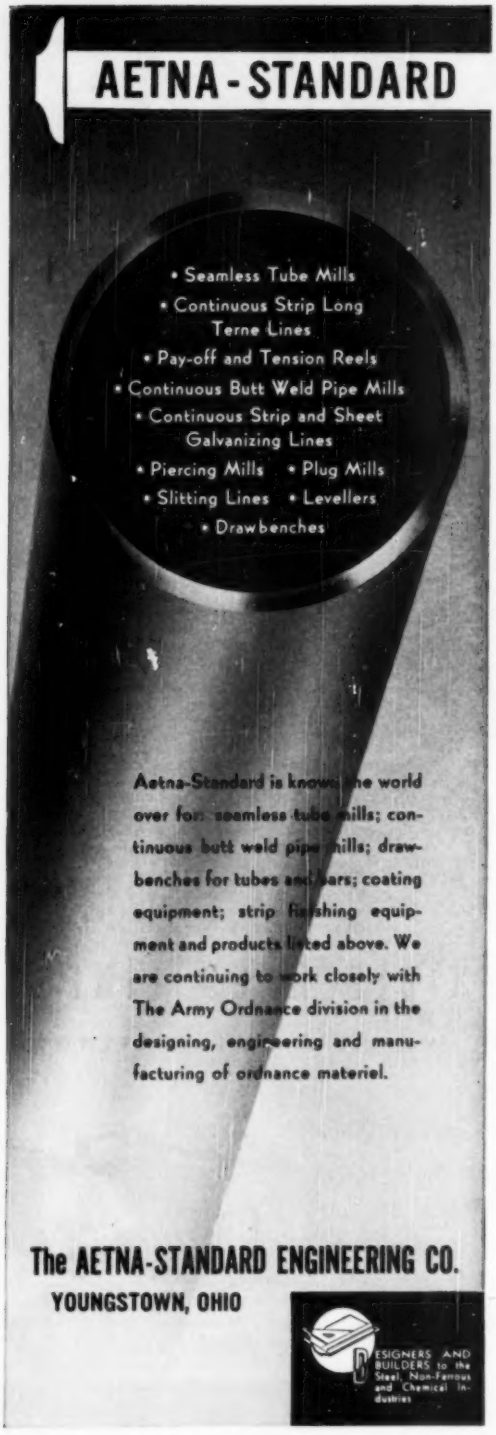
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dling rooms deep in the hull to the gun muzzles, has done away with the task of the gun-turret ammunition handler. Powder bags have been eliminated in favor of cartridge cases to allow safer and speedier handling in this system. Extensive mechanization and greater use of electric-hydraulic controls permits the fastest rate of fire for major-caliber guns ever built into a ship.

TROPICAL TEST CHAMBER

The Army Signal Corps recently developed a tropical test chamber in which delicate communications equipment can be tested under the most severe climatic conditions found in the deepest jungle. The chamber, which is composed of six rooms, is capable of simulating conditions ranging from a fine fog mist to a teeming tropical torrent of two inches an hour. A maximum of 190 degrees Fahrenheit at 100 per cent humidity, plus heavy condensation, can be maintained by the use of temperature and humidity controls, which accelerates the growth of fungi and corrosion on exposed equipment, causing a condition similar to that found in the jungle.

DIAMOND DUST RECOVERY

A unique method recently developed by the Tungsten Process Company, New York City, to recover economically and profitably industrial diamonds and diamond dust from carbide grinding sludge promises to be of great benefit to industry in general and the carbide industry in particular. Residue from grinding operations using diamond wheels up to now has been unrecoverable and washed into sewers as waste material. Now the Tungsten Process Company, which has a pilot line soon to begin operations, hopes to offer significant savings to industries engaged in such grinding operations.

SKYROCKET

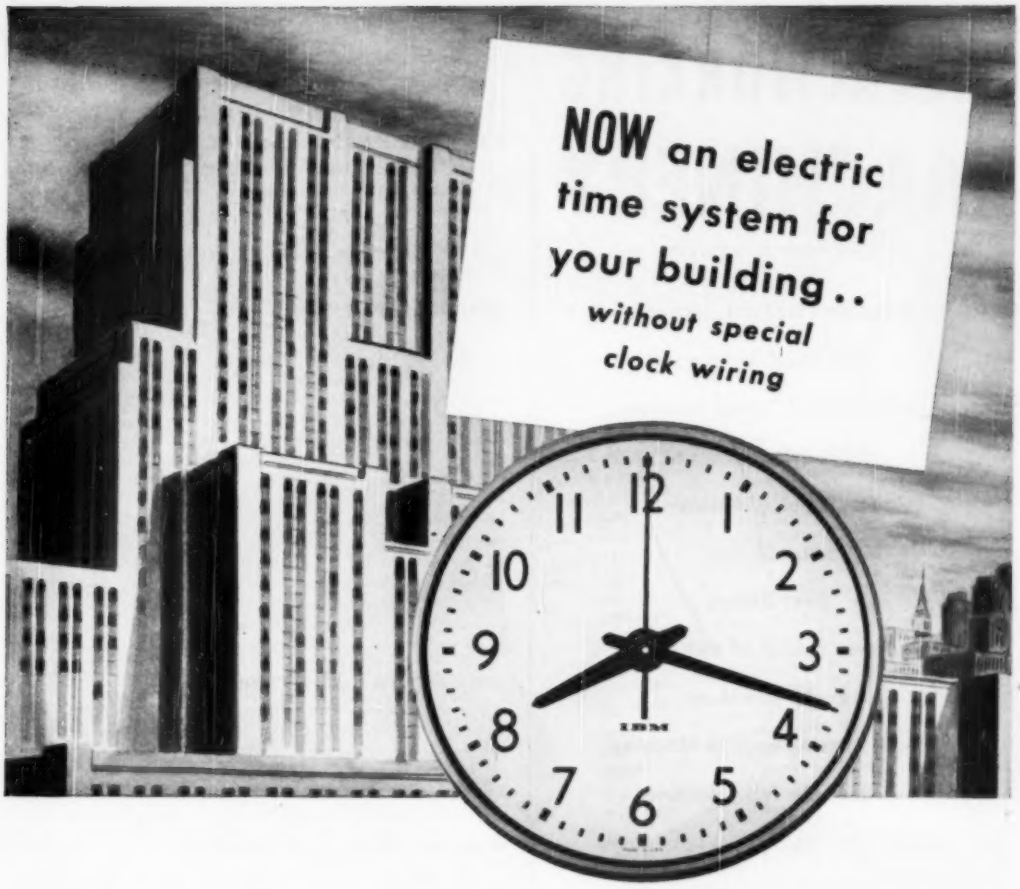
A flight significant to aviation's progress was marked up recently when the Navy's D-558-2 Skyrocket zoomed aloft for its first trial under simultaneous rocket and jet power. Believed to be one of the first flights ever attempted under dual rocket and jet power, the Douglas-built research craft took off from the desert runways of Muroc, Calif., test base. After exhausting its rocket fuel, the Navy test ship continued on a routine research flight and landed under turbo-jet power.

GUIDED MISSILE UNIT

The first guided missile to be fired by a tactical unit of the Army was launched at White Sands Proving Ground, N. Mex., recently. The rocket was fired by personnel of the 1st Guided Missile Regiment, perhaps the most exclusive of present Army units, since it is the only one of its kind. This unit was organized in 1945 as a battalion and was enlarged to regimental size last year. It has been engaged in assisting Army Ordnance and some of the foremost American scientists in tests conducted in connection with research and development projects with the purpose of perfecting the guided missile as a weapon and exploring upper atmospheric regions.

RECOVERY PARACHUTE

Eight modified German V-2 rockets are being fired at the Army's White Sands Proving Ground, Alamogordo, N. Mex., in a program designed to devise methods for parachute recovery of instruments from large rockets used in the upper atmosphere research program. The entire 3,600-pound war head, containing instruments and equipment for upper-air research, is detached from the rocket at a height of approximately 100 miles above the earth. Trailing a 30-foot-diameter pilot parachute, the war head falls freely through the thin upper atmosphere until it is below a 50-mile altitude. At this height the air becomes dense enough to open the pilot parachute fully and pull the 100-foot-diameter



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New Developments

main parachute from its housing. This parachute-recovery method will make possible the recovery of entire smaller rockets and expensive meteorological instruments from large rockets.

NAVY JET ENGINE LAB

Giant blowers to provide the equivalent of speed of 700 miles an hour and atmospheric equipment to simulate altitudes up to 65,000 feet and temperatures down to 67 below zero will be utilized in the $22,750,000 Navy aëronautical turbine laboratory on which work will be started soon at Mercer Field, near Trenton, N. J.

THE HELIOPLANE

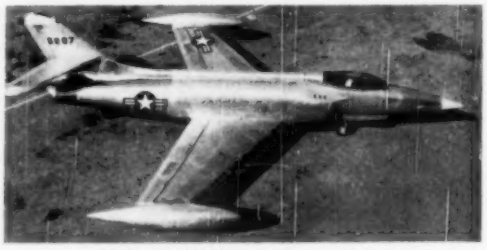
A revolutionary light aircraft, the "Helioplane," has been designed by Prof. Otto C. Koppen and Dr. Lynn L. Bollinger, two Massachusetts professors. Although it looks and performs like a conventional personal plane, it has take-off and landing characteristics which approach that of the helicopter. It is said to be capable of flying at a minimum speed of twenty-seven miles an hour without risk of stalling or spinning. A special system provides for stability and control at very low speeds. Propeller and engine noise is subdued by a "hush box" which Koppen developed and patented. The "Helioplane" is marked by its leading-edge slots, full-span trailing-edge flaps, and split rudder. It is designed to: take off in less than 100 feet—the distance between the fences of a tennis court—in still air with a gross load; take off and clear a 50-foot obstacle in less than 300 feet; throttle down under good control to 27 miles an hour; and cruise at 108 miles an hour on its 85-horsepower engine.

SHIPBOARD ESCALATORS

Moving stairways soon will be helping jet flight operations aboard U. S. Navy aircraft carriers. These first moving stairways to be used aboard any warship will be capable of carrying thirty Navy pilots a minute from the hangar deck up to the flight deck twenty-eight feet above. Navy jet pilots must carry more than forty pounds in equipment when ready for flight.

NEW PENETRATION FIGHTER

The U. S. Air Force's new penetration fighter, the Lockheed XF-90, is designed to operate deep within enemy territory against hostile aircraft and ground targets. Powered by two Westing-



Lockheed XF-90 penetration fighter.

house J-34 axial-flow jet engines, each rated at 3,000 pounds' thrust, the XF-90 has a design gross weight of approximately 26,000 pounds. Employing 35 degrees of wing sweep-back, the fighter has a span of approximately 40 feet, a length of about 56 feet, and a height of approximately 14 feet.

NEW DRY-CELL BATTERY

Development of a dry-cell battery, using magnesium instead of zinc as one of its principal components, has recently been

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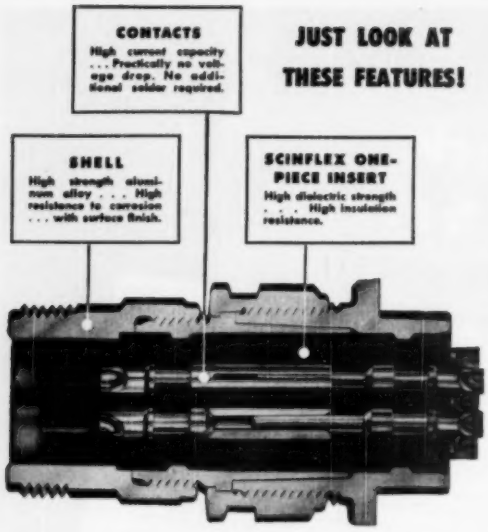
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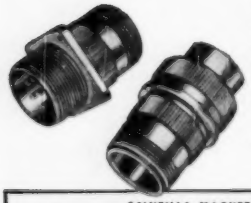

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New Developments

announced by the Signal Corps. The new battery has approximately twice the capacity of the conventional dry-cell type and, unlike other high-capacity batteries, can be manufactured by using the same machinery as used in the manufacture of the conventional dry-cell battery. The battery uses magnesium, a non-critical material, instead of zinc, which is in fairly short supply.

HIGH-ALTITUDE JET ENGINE

Search for a jet engine which will operate efficiently at altitudes above 40,000 feet is under way at the Lockland, Ohio, plant of the General Electric Company. Scientists there have installed equipment which will enable researchers to study why present-day jet engines begin to falter at 40,000 feet. The new equipment, they say, will enable them to study the jet power plant under simulated conditions to altitudes of 70,000 feet and to temperatures of 70 degrees below zero.

NEW VEHICLE HEATER

Two years of development engineering and field testing to perfect a personnel heater which will make it possible for Army ground forces to operate all types of combat and transport vehicles in arctic areas have culminated in the adoption by the Army Ordnance Department of a gasoline-burning heater developed by the South Wind Division of Stewart-Warner Corporation in coöperation with the Detroit Arsenal. Versatility of the heater permits one model to be used on all vehicles, with variations only in voltage and in the accessory group required to install it.

The heater demonstrated its efficiency and dependability in Ordnance Department test laboratories and by field-testing agencies. This successful performance led to its adoption as the personnel heating unit in all current winterization kits developed by the Ordnance Department. It will also be specified as standard equipment on those portions of future contracts for new vehicles destined for cold-climate use.

HIGH-SPEED PILOT EJECTION

Air Force seat-ejection bail-out tests have recently resulted in successful ejection of personnel from a jet plane flying at more than 550 miles an hour. The ejection seat device actually fires the pilot out of the aircraft while he is still strapped to the cockpit seat. The seat is mounted on a tube which extends down its back. This tube fits inside the barrel of the firing mechanism, and the pilot is shot from the aircraft as a 37-mm. cartridge at the base of the tube is exploded. After being ejected, the seat is stabilized by automatically operated flaps and a small drag parachute. This drag chute also rips open the pilot's safety belt and opens a seat-retarder chute which keeps the seat from becoming entangled with the parachute worn by the falling pilot. The pilot's chute is then opened by a static line attached to the seat.

MOBILE PETROLEUM LABORATORY

A mobile petroleum laboratory for the field testing of petroleum fuels and lubricants, lightweight enough to be carried by air and embodying all the refinements developed since the end of World War II, has recently been turned over to the Quartermaster Corps by the manufacturer. Special equipment in the laboratory is capable of maintaining any critical range of temperatures necessary for precise analysis, including tests down to 100 degrees below zero Fahrenheit. The laboratory is equipped to test all grades of gasoline, fuel oils, lubricating oils, and greases. The new unit is contained in a 4-wheel trailer truck and weighs 11,000 pounds fully equipped. The trailer is usually drawn by a 2½-ton truck or a similar prime mover, but in cases of emergency it may be pulled by a jeep.

THE FUTURE HOLDS GREAT PROMISE

Neither chance nor mere good fortune has brought this nation the finest telephone service in the world. The service Americans enjoy in such abundance is directly the product of their own imagination, enterprise and common sense.

The people of America have put billions of dollars of their savings into building their telephone system. They have learned more and more ways to use the telephone to advantage, and have continuously encouraged invention and initiative to find new paths toward new horizons.

They have made the rendering of telephone service a public trust; at the same time, they have given the telephone companies, under regulation, the freedom and resources they must have to do their job as well as possible.

In this climate of freedom and responsibility, the Bell System has provided service of steadily increasing value to more and more people. Our policy, often stated, is to give the best possible service at the lowest cost consistent with financial safety and fair treatment of employees. We are organized as we are in order to carry that policy out.

Bell Telephone Laboratories lead the world in improving communication devices and techniques.

Western Electric Company provides the Bell operating companies with telephone equipment of the highest quality at reasonable prices, and can always be counted on in emergencies to deliver the goods whenever and wherever needed.

The operating telephone companies and the parent company work together so that improvements in one place may spread quickly to others. Because all units of the System have the same service goals, great benefits flow to the public.

Similarly, the financial good health of the Bell System over a period of many years has been to the advantage of the public no less than the stockholders and employees.

It is equally essential and in the public interest that telephone rates and earnings now and in the future be adequate to continue to pay good wages, protect the billions of dollars of savings invested in the System, and attract the new capital needed to meet the service opportunities and responsibilities ahead.

There is a tremendous amount of work to be done in the near future and the System's technical and human resources to do it have never been better. Our physical equipment is the best in history, though still heavily loaded, and we have many new and improved facilities to incorporate in the plant. Employees are competent and courteous. The long-standing Bell System policy of making promotions from the ranks assures the continuing vigor of the organization.

With these assets, with the traditional spirit of service to get the message through, and with confidence that the American people understand the need for maintaining on a sound financial basis the essential public services performed by the Bell System, we look forward to providing a service better and more valuable in the future than at any time in the past. We pledge our utmost efforts to that end.

LEROY A. WILSON, *President*
American Telephone and Telegraph Company.
(From the 1948 Annual Report.)

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American Ordnance Association

To Honor

LOUIS JOHNSON

Secretary of Defense

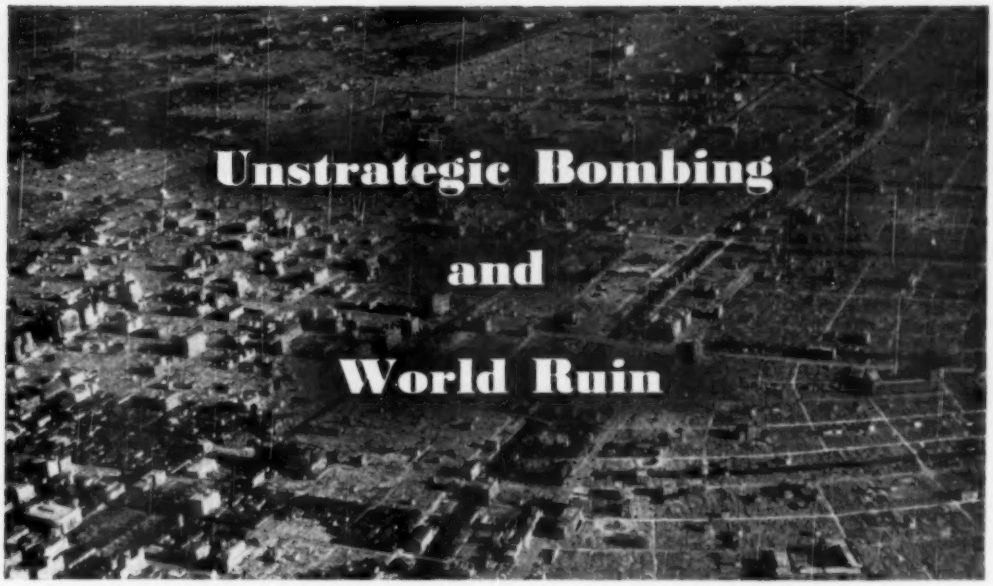
THE Honorable Louis Johnson, Secretary of Defense of the United States, will be honored by the American Ordnance Association at a reception and dinner-meeting to be held at the Hotel Astor, New York City, on Wednesday evening, September 21, 1949, at seven o'clock.

¶ The reception will be held in Parlor A, followed by the dinner-meeting in the Grand Ballroom at seven-thirty. C. Stewart Comeaux, president of the New York Post of the Association, will preside. The Reverend Doctor Charles Trexler, student pastor of Muhlenberg College, will deliver the invocation.

¶ James L. Walsh, president of the American Ordnance Association, will be toastmaster at the dinner and will introduce Secretary Johnson who will address the assembled members and guests.

¶ Members of the Association may bring lady and gentleman guests. Seating will be at tables of ten. Dress: Tuxedo or uniform, miniature decorations. Cover: ten dollars. Personal invitations and reservation forms have been mailed to all members. To assure accommodations at the dinner-meeting, reservations should be returned as soon as possible before the closing date of September 10th after which no seating assignments or refunds can be made.

¶ It is hoped that as many as possible will take advantage of this opportunity to honor the new Secretary of Defense, Mr. Johnson, who has long been a member and staunch supporter of the American Ordnance Association.



Unstrategic Bombing and World Ruin

By Annihilating an Enemy We Destroy Ourselves

by

Maj. Gen. J. F. C. Fuller

Was reason abandoned and morality violated by the indiscriminate bombing of World War II?

AFTER nearly forty years of championing unpopular military causes, I have become accustomed to be misrepresented; but seldom have I been more completely misunderstood than by Maj. John J. Driscoll in his article "The Scope of Air Power," which appeared in the May-June issue of ORDNANCE. It may surprise him to learn—though it should not, for I made it quite clear in my book "The Second World War"—that I am a firm believer in strategic bombing when it is strategic. What I am opposed to is unstrategic bombing, which monopolized so large a part of the joint Anglo-American effort in the last war.

Should such bombing be resorted to in the next war on the scale it was in the last, though again the enemy may be defeated Europe will be economically destroyed and America morally, mortally wounded, because all the high ideals she stands for will, spiritually, be pulverized.

To understand this it is necessary to go far beyond the scope of air power as a means of waging war and inquire into the problem of war as it faces us today. Once this is done it will become clear how air power should and should not be employed.

The Moral Basis of War

Major Driscoll ends his article with a statement so facile that I am sure, were he to think it out, he would reject it. It is: "When an opponent kicks us in the groin, can we still afford to adhere to the Marquis of Queensberry rules?"

My answer is: If we are fighting for the maintenance of Queensberry rules—certain moral values which we hold dearer than life itself—then, whatever our enemy may do, we dare not set them aside; for if we do, our war will become amoral. Either we fight for them or we do not. If we do, we shall show the whole world that morally we are superior to our enemy, and if we do not, that morally we are no better than he. It must never be overlooked that the permanent victory is the moral one. "Either make the tree good and his fruit good; or else make the tree corrupt and his fruit corrupt: for the tree is known by his fruit." Each infringement of the principle of right action is a step toward moral defeat and each adherence a step toward moral victory.

Never has it been more important to remember this than today because the world is divided between two ideologies—two ways of life. The one is Christian or Western, founded on belief in God, a spiritual religion, and certain inviolable rules of conduct. The other is Communist or Eastern, founded on atheism, an economic religion, and expediency. It may be that the second has the greater survival value; as to this the future alone can decide.

General Fuller, noted British soldier-author, is one of the outstanding military analysts and historians of the present day. As an officer in World War I he was one of the foremost advocates of tank warfare and did much to mount the armored attacks that proved the value of the bulletproof track-laying vehicle. He is a Companion of the Bath, a Commander of the Order of the British Empire, and a Companion of the Distinguished Service Order.

But as long as we hold that our rules are righteous, we must abide by them in war as in peace. Should it be argued that in this case we risk losing the war, then, I maintain, though by setting our rules aside we may make more certain of winning it physically, we shall be defeated morally, and by accepting war without rules we shall end by establishing peace without rules also.

The Economic Basis of War

It would be a platitude to state that the foundations of present-day physical warfare are industrial. Nevertheless, though equally obvious, it is frequently overlooked that the reason for this is that our civilization is an industrial one, based not only on factories but also on cities, the centers of invention, management, distribution, and exchange. The difference between it and its agricultural predecessor is the growing interdependence of nations. Though politically still divided, as a whole the world is becoming more and more economically integrated, and, in consequence, the economic injury done to an enemy nation in war, if severe, from a mere self-inflicted scratch becomes a serious self-inflicted wound.

Here we are faced by a dilemma: not only is physical war dependent on industrial power and city life, but our civilization is also dependent on them. Destroy the factories, and the cities become shells; destroy the cities, and the wheels of industry cease to turn. Destroy both, and civilization reverts to barbarism and through barbarism back to a purely agricultural civilization.

How can we wage war without injury to our common civilization? We cannot, for physical war in its very nature demands economic destruction. In the past, when field lands were devastated they were soon restored; but cities take incomparably longer to recover. The world is dotted with dead cities standing like tombstones over civilizations destroyed by war.

"We Shall Perish"

That in war we must wound our civilization is certain; but should we wound it mortally, we shall perish with it. Therefore, in depriving our enemy of his industrial war power we must do our utmost not to inflict a mortal wound on our common civilization.

"The destruction of cities, the centers of integration of civilized life," writes Prof. E. L. Woodward in "Some Political Consequences of the Atomic Bomb," "has happened before and has resulted in anarchy and darkness. The process was mainly one of slow decay, and just because it was slow, the possibilities of recovery were never entirely removed. The danger is now that we should be plunged into anarchy at once and that we could no more organize recovery than a finely bred dog could long fend for himself if he were turned loose in the jungle."

The political aim in war depends upon whether the cause of war is biological or sociological; that is, whether it is related to the life struggle of a people or the struggle between the associated lives of two or more peoples. For example, should a country become so overpopulated that its people cannot subsist on the products of their land and their trade, they will invade a neighboring country; and should that country be similarly situated, the war will become one of extermination in which one of the two peoples will finally perish.

On the other hand, should some vital difference in their associated lives arise which cannot be settled by argument, then, should war be resorted to, instead of its aim being to exterminate the enemy, it will be to compel him by force of arms to change his mind and accept his opponent's policy.

In the one case the political aim is the extermination of the enemy; in the other, the settlement of a dispute with as little loss to both sides as possible, because the more the potentials of civilization are consumed in war, the worse will be the position of victor and vanquished on its conclusion. Within a generation this has happened twice—in 1918 and in 1945.

In short, as General Sherman once said: "The legitimate object of war is a more perfect peace." Such a peace is impossible if during a war we jettison the very principles we say we are fighting for and economically wreck the civilization to which both we and our enemy belong. Therefore, for the political aim to be profitable, victory in itself is not sufficient; for to "win" and be engulfed in a common ruin is insane.

The Strategic Purpose In War

The purpose of strategy is to create a military situation which will enable the political aim to be profitably attained. Hence strategy is intimately related to politics. Thus in past ages, when wars were frequently fought to obtain slaves, to kill off the enemy did not fit the problem. Also today, when wars are frequently fought to obtain commercial advantages, to convert the enemy's territories into a desert is no solution.

Less noticeable, should the political aim be an ideological one, such as extirpating a heresy or a political creed, because shells and bullets cannot kill ideas the sole way to create a situation in which the political aim can be won profitably is to display a pronounced moral ascendency over the enemy in the conduct of the war. Should he fight like a cad, whether it be to your physi-

This was a railroad yard at Rheine, Germany—a legitimate target for strategic bombing since the town was an important war traffic center.

cal advantage or not you must fight like a gentleman, and if from the start you have no intention of doing so, the situation is in no way bettered by playing the hypocrite.

In the present age of contending ideologies the supreme difficulty is that wars are largely ideological. Further, the radio enables a belligerent instantaneously to attack the mind of his enemy, and the airplane his body and possessions in a matter of minutes or hours.

In the sociological wars of the recent past, warfare was restricted to armed forces, and the assumption was generally held that a decisive defeat in the field would compel the enemy to sue for peace, when diplomatic relations would be resumed round the peace table —the vanquished being deprived for the time being of the power of reënforcing his argument with force. In these wars the aim was either to eliminate the fighting forces of the enemy or so reduce their strength that he was compelled to change his mind.

Opposed to this is, comparatively speaking, a new idea; namely, that because the fighting forces of the enemy depend for their material and moral maintenance in the field on the industrial power and moral strength of the enemy's civil population, if these be destroyed, his fighting forces will be rendered innocuous.

This was the theory which, under the misguiding name of "strategic bombing," was put into practice during the last war in order to create a military situation favorable for the attainment of the allied political aim—the extirpation of Hitlerism. What was the result? Though Germany was defeated and National Socialism overthrown, Russia and Stalinism took their place. Great Britain was bankrupted, and her Empire is now in a state of dissolution, and yearly America is spending billions of dollars to stem the Communist flood. Politically, this "worth-while experiment," as Mr. Churchill called it, was a catastrophic failure.

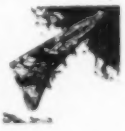
Strategic Bombing

Granted that the purpose of our strategy is to create a military situation which will enable statesmen to attain their political aim; and granted that the political aim is to establish a peace in which Western morality can thrive and Western civilization continue, it is clear from what I have written that the strategic bombing resorted to in the recent war will not foot the bill.

The atom bombing of a town like Hiroshima, as pictured above, would be contrary to Fuller's thesis since a whole area was indiscriminately destroyed.

The people responsible for its adoption were not the airmen but the statesmen, and in particular Mr. Churchill who, though in peacetime his color is blue, in wartime invariably sees red. It was his Timurian policy which carried the day at the Casablanca Conference in January 1943 when it was categorically laid down that the aims of strategic bombing were "the destruction of the German military, industrial, and economic system and the undermining of the morale of the German people."

This policy was further elaborated by Churchill in his address to Congress on May 19, 1943, in which he boasted of "unparalleled devastation." This policy, coupled with that of "unconditional surrender" which fortified the will of the Germans to resist to the end, meant a rehabilitation of the conditions which prevailed in the Thirty Years' War. In the words of Ferdinand II, "Better a desert than a country ruled by heretics."



How was this policy of devastation implemented? A priority list of large and medium-sized German towns was made out in which each town in turn was marked down for obliteration. What was the method employed? It is described by Sir Arthur Harris, in whose hands British strategic bombing was entrusted. To quote his words:

"But it must be emphasized that in no instance except in Essen (where the factories were in the center of the town) were we aiming specifically at any one factory during the Battle of the Ruhr; the destruction of factories, which was nevertheless on an enormous scale, could be regarded as a bonus. The aiming points were usually right in the center of the town. . . which was naturally more densely built up than the newer and well-planned suburbs; it was this densely built up center which was most susceptible to area attack with incendiary bombs."

"Right in the Center"

Next, after listing a number of German towns, he adds: ". . . all were heavily attacked and in most instances heavily damaged, the devastated areas amounting to hundreds and in some cases to thousands of acres, usually right in the center of the city." Therefore it was the centers of civilization and not military objectives which were attacked.

Whether the same method was resorted to by the American strategic bombing forces, I am unable to say. Nevertheless, though Maj. Gen. Edward P. Curtis, chief of staff to Gen. Carl Spaatz, in a letter published in the same number of ORDNANCE in which Major Driscoll's article appears, says that he "can testify without fear of contradiction that no mission was ever sent out which did not have as its target a vital military objective," I would ask him what vital target was there to be found in Dresden when it was mercilessly bombed by American and British aircraft in February 1945? Should it be claimed that the city was a road center

and that it was essential to prevent the Germans using it in order to stem the Russian advance, then all that was necessary in order to neutralize it was to keep its exits under continuous air bombardment.

An even worse case, and one either of sheer stupidity or of vandalism, occurred a month later when it would have been thought that, as the war was then rapidly approaching *rigor mortis*, every effort would have been made to limit destruction. Hildesheim, one of the most perfect examples of medieval towns in Europe and possessing no military significance (the railway junction is outside the town), was obliterated by the U.S. Air Force. Why? Merely because its time had come, its number had turned up on the schedule! It was down for destruction; therefore it was destroyed.

Because I hold that this type of bombing is unstrategic, Major Driscoll jumps to the conclusion—why, I cannot imagine—that I alone favor "the *tactical support rôle*." Next, he goes on to say: "The strategic bomber has unquestionably demonstrated the ability to perform the following tasks in addition to the limited tactical rôle envisaged by General Fuller: Air defense; air superiority; reconnaissance; armed transport of troops and supplies; preparation for landing; cover for amphibious and land operations; antisubmarine warfare including reconnaissance, bombing, and mining; security against invasion; ground support operations at long ranges; dropping of saboteurs and agents; destruction of enemy air forces."

This bewilders me, for they are the very operations which I advocate, though I would not class them all as strategical.

What I am opposed to is not these most sensible operations, but instead obliteration bombing carried out either at short or long ranges—in the first case without reference to the eventual movement of troops and in the latter without reference to the political aim. But to return to strategic bombing as correctly defined. I have never suggested that it is futile, as I am accused of doing, and when Major Driscoll writes: "The basic theory of strategic air operations was to locate and destroy the fewest possible vital links in the enemy's production machine, irrespective of general production levels." I fullheartedly agree. And what were the "fewest possible vital links"?

Two Principal Targets

From the earliest days of the war my opinion was that there were two main categories of targets: the sources of industrial and military energy and the means of industrial and military movement. In other words—coal, oil, and transportation. Again and again I pointed out that if the first two could be steadily crippled, eventually the bulk of the enemy's factories, railroads, and all gasoline-propelled machines and vehicles would come to a standstill.

But as this would take time, pending effective paralysis through lack of coal and oil, I suggested that important centers of rail and road communications, as well as extensive marshalling yards and vital bridges were, strategically speaking, legitimate targets. The supreme advantage of selecting the fewest possible targets is that bombing can be concentrated, and the main disadvantage is that the fewer the targets, the more the enemy can concentrate on their defense. When in May 1944 it was decided to concentrate bombing on German railways leading westward into France and on German synthetic oil plants, this is what I wrote in my "The Second World War": "At long last, strategic bombing was, for the time being at least, to become strategic."

Finally, I agree with the Strategic Bombing Survey, from which so much of my evidence is drawn, and more especially so when it says: "Allied air power was decisive in the war in Western Europe." But I disagree with what immediately follows: "Hindsight inevitably suggests that it might have been employed differently or better in some respects." It was not a question of hindsight or of foresight but of sheer common sense; and to put it down to hindsight is the most terrifying aspect of the whole argument. For if it be necessary to carry out so costly and devastating an experiment as unstrategic bombing in order to discover that factories and armies cannot work without coal, oil, and transport, then, heaven help us, we must be a race of dolts.

This brings me to my last point, which though political is intimately related to unstrategic bombing. We Europeans are a truculent congeries of nations who have been fighting each other for upward of 2,000 years, and we dislike outside interference. In 1917, you Americans stepped into the war to save one side, and whatever at the time we may have asked for as Englishmen and Frenchmen, as Europeans we did not want to be saved by a non-European power; instead what we really wanted was to settle our quarrels in our own historic way. Had you not stepped in, we should have been forced to come to terms between ourselves, as we have done scores of times before. Without your aid, and it was generous, we Europeans would have concluded the first World War, probably in 1917, by a negotiated peace which could not have been worse than the one established.

Again in the last war, what with your lend-lease, etc., you got entangled in the European brawl, and between 1942 and 1945, backed by your enormous industrial power, you laid the greater part of Central Europe flat. But for lend-lease the war could not have continued for long. Again there would have been a negotiated peace, which could not possibly have been as bad as the present so-called one. Though it is true that it would almost certainly have been followed (if not preceded) by a war between Germany and Russia, nothing could have been more beneficial to the world at large; for in it the two dictatorial powers which were threatening the Western way of life would have bled each other white. To imagine that Hitler, had he conquered Russia in Europe, could have held it for long, is a joke.

It needed no hindsight to see these things, only a modicum of foresight; but, sad to say, this was lacking. Europe is now impotent either to make peace or wage war, and today she is hanging round your neck like the ancient mariner's albatross. If you abandon her, she will be turned Red; if you do not, there is a high probability that there will be another war. And now comes *the* question: Next time, are you going to resort again to unstrategic bombing? If you do, the probability is that Europe will end by becoming a scarlet jungle.

Thus we return to the opening sections of this article. What are your moral principles; what is your political aim? Are you going to fight in accordance with Queensberry rules or are you bent upon winning another total victory?

Coast Guard

Soldiers ARE Citizens

The Military Man, Too, Wants Peace and Freedom

by

Bernard M. Baruch

"We should stop thinking that a soldier is set apart from the rest of the people"

USUALLY my Industrial College talks have centered around the problems of economic and industrial mobilization. Today I intend to include in my text a somewhat different subject.

Not that there is less urgency for the immediate adoption of a plan of total mobilization. The necessity never was greater. If war is to be prevented, we must be ready to see the Atlantic Pact through. With its ratification the United States will be formally committed to go to war in event of aggression. Let no one have any doubt on that score. Yet, with the cold war dragging into its fourth year, we still lack any effective plan for the swiftest possible mobilization of our resources to ensure reaching our allies in time.

At the close of the war Congress created an agency to draw up and recommend mobilization plans. When this agency attempted to act, it was prevented from doing so. It has still to be heard from.

What needs to be done is well known. The mobilization experience of the last two wars should be embodied in the best possible plan that can be devised as of today and promptly enacted into law, ready to be put into effect on proclamation of the President with the concurrence of Congress.

What is lacking is a will to decision. The Congress and the American people are entitled to a full report on the status of these mobilization plans. The responsibility for this neglect should be made clear before it is too late. Additional delay is a needless gamble with our national security—a needless invitation to disaster.

But the importance of mobilization is obvious and imperative. Of even greater consideration are the types of men who operate our Military Establishment. So, I should like to say a few kind words for the so-called "Brass Hats," who are being sneered at and sniped at so unjustly. They deserve better at the hands of the public.

We should stop thinking that the soldier is set apart from the rest of the people. This is bad thinking. A soldier, whether he be an officer or a private, is still a citizen. In fact, he is first of all a citizen. So is a veteran!

Civilians and Military

The whole thesis that there exists some deep fundamental cleavage between "civilians" and "military" in American life breaks down on examination. The soldiers who have been called upon to function in spheres apart from their profession of arms have rung up enviable records. Our occupation commanders—MacArthur, Clay, Clark, Hodges—have handled themselves with ability and tact, with justice and firmness. They, their officers and enlisted men, have won new respect for the United States.

In Bedell Smith we had an excellent ambassador to Soviet Russia. Admiral Kirk is a worthy successor. There has been no more capable administrator of veteran affairs than Gen. Omar Brad-

Mr. Baruch delivered this address at the commencement exercises of the Industrial College of the Armed Forces in Washington, D.C., June 28, 1949.

ley. Less conspicuous, but no less real, was the ability shown by Marine General Erskine as Retraining Administrator in an impossible situation.

No Secretary of State has been less militaristic and more devoted to searching for peace than General Marshall.

Our civilian life has been greatly enriched by the addition of professional soldiers, General Eisenhower being only the most recent example.

There is no basis for the accusation that our military leaders think exclusively in terms of "war." Today the professional soldier is trained in the arts of peace as well as those of war. That, as you know, has been one of the objectives of this Industrial College.

I know of no group who have been so loyal to the country as a whole. The question never arises of protecting one region—say New York or Texas—at the expense of others. The military has always thought of the whole national interest, which is more than can be said for some of their critics.

By whom have American liberties been threatened in the past? By the military? Or by reckless civilian politicians and rabble-rousers? The rôle of the soldier in the United States has always been that of the protector of our liberties. In times of peace all too many people have tended to jeer at members of the armed forces, to laugh off their warnings, to give little heed to what they have sought for defense. Then, suddenly, war erupts! The much-maligned military are expected to spend billions in furious yet efficient haste, to recruit and train in a matter of months millions of men who never held a rifle before, to organize global operations touching places most Americans had never heard of. Certainly it is one of the marvels of American history that our armed forces have not failed us in time of war, despite the treatment given them during peace. This story is told in Kipling's "Tommy Atkins."

The pay we civilians give our soldiers has never been commensurate with the responsibilities we thrust upon them. That is particularly true now when inflation has slashed the real value of all pensions, savings, and salaries. Grave responsibilities with inadequate reward and exposure to unfair criticism is too often the lot of occupants of the Pentagon—which I hope to see renamed the James V. Forrestal Building.

Not all who have been wounded in the service of their country wear Purple Hearts.

A Significant Sign

Were today's abuse of the military merely a question of the specific charges being made it would be of small concern since the evidence refuting these accusations is so readily at hand. However, the outcry against the "brass" is the outward sign of something deeper.

In ancient, more primitive times it was often the practice to beat or kill a courier who brought bad news. That is somewhat the plight of the military in America today. Because of the cold war, the atomic bomb and other ocean-shrinking weapons, and the collapse of European and Asiatic power, preparations against war intrude ever more insistently into all our lives. Before Hitler, defense appropriations cost each American only a few dollars a year. We now pay $100 annually—each of us. For the first time in our history, young men have been drafted before actual war. . .

Bear this fact in mind—the American people are currently in the throes of tormenting, frustrating readjustment. Both as a nation and as individuals we grew up accustomed to regard war and peace as distinctly separate states, like day and night. Today we live in an around-the-clock twilight of neither war nor peace. Reared to think of war as a brief emergency to be rallied to temporarily, we find ourselves confronted by a continuous threat of war, which required something Americans have habitually lacked—a see-through constancy in action between peace and war.

Feast and Famine

This necessity to adjust to the inexorable continuity between peace and war which prevails in our world will force revolutionary changes in the thinking of the military as well as civilians. In the past, for example, defense appropriations fluctuated wildly in a "feast and famine" cycle. Unfortunately our budgetary habits are still attuned to that cycle. For the cold war we must scale defense expenditures so they can be sustained indefinitely—paced to the needs of changing world developments—without overburdening our economy. . .

The cold war is as total as actual war. It requires not military readiness alone but a strategy embracing all fronts, a strategy which rises above the race of selfish groups who seek to better themselves at the expense of others, even to where it endangers our very government.

To arrive at the proper balance will require painful decisions by both the military and civilians. Within the Defense Establishment a unified strategic concept must be agreed upon, with expenditures restricted to what is absolutely needed—not what is wanted or even desired.

Civilians Must Decide

On the part of the civilians, there must be an end to prevailing indecisions. An over-all global strategy for prolonged peacewaging must be formulated. I have always believed in civilian control of our national life, both in war and peace. But civilian dominance has its price—a readiness to make the decisions which the military must have to carry out their assigned duties. The failure to enact a mobilization plan is only one instance of this vacillation. . .

For more than half a century I have been associated with members of the armed forces. In all that time I have never met a so-called military man who was not as fervently desirous for peace as the ordinary civilian. I have watched the defense agencies spend billions, and, while there have been lapses, on the whole the record has been better than any comparable operation in civil life. Nor have I ever detected in the military any tendency to usurp power or to do anything other than safeguard our freedoms.

Not "Secondary Citizens"

The men who commanded on land and sea and in the air, and those whom they commanded, gave new dignity to the spirit of America. I resent the implication that these war leaders are less able or less willing to discharge their duties in peace. I reject the theory that they think narrowly and rigidly in terms of war. I oppose any effort to force them into secondary citizenship.

You gentlemen can leave this institution with pride in the training you have received and with greater pride in what you symbolize—the ability of the American democracy to fuse professional soldiering with a love of liberty. If at any time in the future you find yourself being called a "brass hat" take it as a compliment. I would be proud to be known as one.

Gunnery and Guided Missiles

Fort Bliss Lays the Foundation for Developing New Ordnance Techniques

by

Maj. Gen. John L. Homer

The end of World War II marked the beginning of an era of revolutionary weapons and concepts

THE vital necessity for effective defense against any and all kinds of attack from the air whether it be planes, bombs, rockets, or yet-unheard-of weapons, makes the mission of the Army's Antiaircraft Artillery and Guided Missile Center at Fort Bliss, Tex., one of the most fascinating and important operations being conducted in the National Military Establishment today. The employment of air weapons of supersonic speeds during World War II has marked the beginning of a new era in the art of waging war, and the use of these weapons has forced upon us new concepts of time, space, surprise, and mobility. New jet-propelled weapons have made possible a striking force far beyond all previous conceptions.

The depth of the combat zone is constantly growing, and as each milestone is passed by military and scientific developments, it becomes daily more difficult to distinguish between the zone of the interior and the combat front. The vast amount of research and development on new antiaircraft and guided-missile weapons being conducted in and around Fort Bliss will play a large rôle in the trends of modern combat. Thus, the task of Ordnance engineers and technicians in supporting these activities is one of considerable magnitude. Ordnance personnel working in conjunction with the antiaircraft and guided-missile program are playing an outstanding part in the activities concentrated in this area.

The training of men by the Army Field Forces to operate antiaircraft and guided-missile weapons has come as a natural and necessary accompaniment to the research in and development of these revolutionary new weapons. At the Antiaircraft Artillery and Guided Missile Center, training of personnel to operate new weapons progresses hand in hand with the various phases of research, development, and testing.

The center has been located at the border post of Fort Bliss in West Texas since its activation in July 1946. It was established to coördinate all antiaircraft artillery and guided-missile activities of the Army Field Forces and to promote their development. This move was also in line with the Army Field Forces' policy of keeping abreast of every new development in military science. Activities at the center call for extensive development, practical tests, and demonstrations in the antiaircraft and guided-missile field, with special reference to the related use of guided missiles as artillery weapons. One of the many steps forward has been the development of tactics, techniques, and organization of guided-missile units for use in the Army Field Forces.

Component Organizations

To appreciate the background provided for antiaircraft and guided-missile training at Fort Bliss it is necessary to know something of the organization of the center itself. Here is concentrated the antiaircraft and guided-missile activities of the Army Field Forces. Included within the organization of the center are: The Antiaircraft and Guided Missiles Branch of the Artillery School; Army Field Forces Board No. 4; the 1st Guided Missile Regiment; Fourth Army General Reserve Units (including three newly formed brigades); and the Post of Fort Bliss. All these organizations are under the commanding general of the Antiaircraft and Guided Missile Center. Also an integral part of the Fort Bliss Reservation—but reporting directly to the Chief of Ordnance—are the White Sands Proving Ground in New Mexico and the Research and Development Suboffice (Rocket). Adjoining the reservation are William Beaumont General Hospital and Biggs Air Force Base.

Field Forces Board

Army Field Forces Board No. 4 works in close liaison with the guided-missile testing agencies at White Sands Proving Ground and the activities of the Ordnance Research and Development Suboffice (Rocket) as well as certain Air Force commands in this area. The mission of the board is directed toward antiaircraft artillery and guided-missile development, and in the accomplishment of this mission it carries out a number of diverse functions.

Also located at Fort Bliss is the Antiaircraft and Guided Missiles Branch of the Artillery School. Here the faculty and students have advantage of the almost limitless antiaircraft artillery range area as well as access to the latest developments of the board and other center activities.

The school is concerned with instruction in antiaircraft and guided-missile subjects to both officer and enlisted students of all components. In the accomplishment of its mission, the school is composed of six instructional departments, which include gunnery, guided missiles, electronics, tactics, instructional methods, and the special associate basic course. In addition there are two special departments which include training publications and aids, and research and analysis.

The Gunnery Department, representing the hitting power of all heavy and light antiaircraft artillery, is charged

General Homer is the commanding general of the Antiaircraft Artillery and Guided Missile Center at Fort Bliss, Tex.

with keeping the antiaircraft artilleryman up to date on all phases of gunnery, fire control, and matériel concerning antiaircraft weapons. Based upon the knowledge gained throughout many combat operations and the unprecedented growth of antiaircraft artillery during World War II, newly developed techniques and the latest improvements in equipment are utilized in keeping the gunnery courses abreast of the times.

The Guided Missiles Department, maintaining close liaison with other guided-missile activities and research projects, is making available to students of resident instruction the results and conclusions drawn from the testing and research work carried out by some of our country's leading scientists in this field. A wealth of information, proven theories, and new fields of research and discovery are obtained as each guided missile is launched.

The Electronics Department, working in a field no less fascinating than guided missiles, keeps the student abreast of all the latest communications and radar equipment and up to date on all new developments.

The responsibility for planning and directing instruction on the tactical employment of antiaircraft artillery weapons and associated equipment belongs to the Tactics Department. The flexibility of antiaircraft artillery, derived from its tremendous firepower and high mobility, makes it an integral part of our armed forces. Because of the vast amount of highly technical equipment, the task of ordnance support is no less important in the over-all picture. Here, in the Tactics Department, the student becomes familiar with the techniques of antiaircraft operations with the Infantry, Armored Forces, Airborne Forces, and the Air Force.

Instructional Methods

The Instructional Methods Department, using the basic principles outlined in Department of the Army publications which proved so successful in quickly training an army of 7,000,000 men for the last war, gives instruction in the preparation of material for presentation in the classroom and in the field. It also shows the proper preparation of lesson plans, the correct use of types of instruction to fit the material to be presented, the use of training aids and the blackboard, and how to speak effectively. This department also teaches the designing of tests and examinations, their use, administration, and marking systems.

The Department of Special Associate Basic Courses has the mission of training prospective second lieutenants in the basic principles of the military service and the technical aspects of antiaircraft artillery. During the course of instruction emphasis is placed upon developing the qualities of leadership and command.

In addition to the comprehensive program of resident instruction within the school, the special Department of Training Publications and Aids prepares field and technical manuals, Army extension courses, and other training literature covering all phases of antiaircraft and guided-missile activities. Field and technical manuals are constantly being written and revised to conform to new doctrines and principles as they are developed through study and experimentation. Antiaircraft Artillery Army Extension Courses prepared by this department form an integral part of the Army-wide extension-course program, and are available for all levels of instruction from the lower enlisted grades through the commissioned grades as high as major.

Completing the list of departments under the school is the Research and Analysis Department. An example of one of the many tasks that falls upon this department is the painstaking work of compiling statistics on the behavior of thousands of rounds of fired ammunition, thereby providing the technical information necessary to effect improvement in design, construction, and operation of matériel.

Another interesting project is the further development of the art of flak analysis, a method originated during World War II for estimating the safest bomber routes through enemy antiaircraft artillery fire. This subject is also being studied and developed from the viewpoint of friendly defense planning with an objective of establishing the best defense possible.

Guided Missile Training

Training military personnel at the center for work with guided missiles follows three major lines: First, the presentation of study courses in guided-missile subjects under the supervision of the Antiaircraft and Guided Missiles Branch of the Artillery School; secondly, the actual work of the men of the 1st Guided Missile Regiment who assist in the experimental firings at White Sands Proving Ground, N. Mex., and with other research installations elsewhere; and thirdly, the formation, training, and instruction of guided-missile battalions in the Organized Reserve Corps.

Of particular interest in the courses offered at the school is the 37-week

Army photo.

The program at Fort Bliss encompasses all aspects of antiaircraft gunnery. The M19 gun carrier, the nemesis of strafing planes, combines firepower and mobility.

guided-missiles course. It is designated to indoctrinate officers of the armed forces with the fundamentals, tactics, and techniques in the field of guided missiles. From these studies conclusions are drawn as to the most probable development of guided missiles and high-velocity weapons for the immediate future. Students are encouraged to develop tactical doctrine and theories for the employment of these weapons and to plan defensive measures.

During the course of instruction students are afforded field trips where they visit various Ordnance research and development installations throughout the United States. This gives the guided-missiles officer an opportunity to gain firsthand knowledge of the very latest developments in this field.

Army photo.

A group of officer students receive instruction on the ROC guided missile at the Fort Bliss school.

Unique Regiment

The 1st Guided Missile Regiment, only organization of its kind, is an outgrowth of the 1st Guided Missile Battalion. The regiment is unique in that it is "branch immaterial" with respect to officers and enlisted men. All the ground arms and several of the services are represented. The unit is assisting Ordnance personnel in the preparation and launching of experimental guided missiles. In February 1947, personnel of the originally organized battalion launched the first guided missile ever to be prepared and fired entirely by Army Field Forces troops. This unit has been the experimental guinea pig for other guided-missile unit organizations. As a result of the experience gained thus far, proposed tables of organization have been developed and submitted to Army Field Forces for consideration.

Men of the 1st Guided Missile Regiment are responsible for a variety of tasks. Within the framework of this organization soldier mechanics and electricians assist civilian engineers in missile assembly. Soldier machinists and sheet-metal workers make repairs and fabricate small parts. Ground crews handle the transporting, erecting, fueling, orienting, testing, and firing of a variety of missiles. An instrument group assists personnel of the Ballistics Research Laboratory of Aberdeen Proving Ground in manning radars, plotting boards, timing equipment, transmitters, theodolites, electrical precision cameras, and many other devices used during the firing of missiles. Future activities and developments will be reflected in this unit and similar units that may be organized.

The third phase of guided-missile training at Fort Bliss is that of the guided-missile battalions of the Organized Reserve Corps. It is quite natural that the first guided-missile battalions to be organized among the civilian components of the Army should get their start at the Antiaircraft Artillery and Guided Missile Center. The several hundred Army Field Forces Reserve officers in the El Paso area have their headquarters and hold regular meetings at Fort Bliss. Officers from the Antiaircraft and Guided Missiles Branch of the Artillery School and other center organizations frequently visit and serve as instructors at the Organized Reserve Corps troop schools.

In order to keep the Reserve components abreast of active developments, two Reserve guided-missile battalions have been established in the El Paso area. Their interim training program will cover the organization and duties of the different sections of the battalion, familiarization with the basic principles of guided missiles, and study of all available technical papers or books on this subject. Purpose of the guided-missile battalion in the Organized Reserve is to build up, over a period of time, as large a number of guided-missile personnel as possible who are familiar with the technical and tactical requirements in this new field.

The importance of the Antiaircraft Artillery and Guided Missile Center in the National Military Establishment is reflected in the recent expansion of all types of antiaircraft units at Fort Bliss. Of particular interest are the three newly activated antiaircraft artillery brigades under the command of the center. These brigades will supervise the training of both individuals and units as they develop into efficient combat organizations to take their place in the over-all national defense.

The first postwar R.O.T.C. camp at Fort Bliss was conducted during the summer of 1947 under the direction of the center. A total of ninety-three cadets reported for the summer training period. Training followed a pattern set by resident instruction at various schools and universities. The center provided ample facilities for carrying out this mission.

No article about the Antiaircraft and Guided Missile Center is complete without a brief description of Fort Bliss and the surrounding area. Here nature and man have combined forces to provide an ideal locale for the increasingly important work of the center. Fort Bliss is a well-established post with plenty of space and facilities for expansion. The mild West Texas climate provides year-round firing weather, with little rain, fog, snow, or other climatic interference. The cloudless skies permit unlimited visibility, and the desert areas furnish the large ranges so necessary for antiaircraft and guided-missile firing. The adjacent city of El Paso, an important rail center of approximately 140,000 population, is a friendly community for military personnel and their families.

For Eminent Service We Salute These Industry-Ordnance Leaders

H. C. Fruehauf

G. G. Mullinix

R. C. Burton

M. M. Johnson, Jr.

Vice Adm. G. F. Bogan

Harvey C. Fruehauf, Detroit, Mich., is chairman of the board of Fruehauf Trailer Company which he helped to found in 1915. During World War II this company designed and developed many new trailer types for the armed forces. Mr. Fruehauf is first vice-president of the Michigan Post of the American Ordnance Association.

G. Grover Mullinix, ammunition inspector with the 3rd Service Command of the Second Army, has an outstanding record of more than thirty-one years of civilian service with the Ordnance Department. During that time he has never been absent from work because of illness. He recently received the Meritorious Civilian Service Award.

Robert C. Burton, Kingsport, Tenn., is general superintendent of the Tennessee Eastman Corporation. During World War II he aided in the development of the Bachman RDX process and was general superintendent of production at the Holston Ordnance Works. He is a member of the Powder and Explosives Committee of the A.O.A.

Melvin M. Johnson, Jr., New Haven, Conn., inventor of the Johnson semi-automatic rifle and the Johnson light machine gun, has long been a staunch supporter of the Ordnance cause. Recently transferred from the Marine Corps Reserve to the Ordnance Department Reserve as a lieutenant colonel, he is the author of "Automatic Weapons of the World" and numerous other gun books.

Vice Adm. Gerald F. Bogan, commander of the First Task Fleet, U. S. Navy, was host to American Ordnance Association members and guests at the naval demonstration during the Thirty-first Annual Meeting at Los Angeles in April. Admiral Bogan has a long record of accomplishment in ships and aircraft both in peace and war. He won the Navy Cross for heroism during World War II.

Alfred H. Hobelmann, Washington, D.C., is assistant vice-president of Walter Kidde & Company engaged in the design, installation, and servicing of fire-fighting equipment, oxygen breathing apparatus, air-sea rescue equipment, and other devices used by the armed forces. Mr. Hobelmann is president of the Washington Post of the A.O.A.

George A. Uhlmeyer, Rock Island, Ill., is Quad Cities Zone Manager of the Iowa-Illinois Gas and Electric Company. During World War II he helped solve many power and fuel problems in the Rock Island area. He was recently elected president of the Quad Cities-Iowa Post of the A.O.A.

Col. Thomas C. Musgrave, Jr., now a student officer at the National War College, Washington, D.C., was the former commander of Mitchel Air Force Base, N.Y. He was wounded in action with the Fifth Bombardment Group in the South Pacific during World War II.

I. A. Kinsey, Richmond, Va., is executive vice-president of the Tredegar Company—an historic organization that has furnished both the Army and Navy the major portion of their target-practice projectiles for the past fifty years. Mr. Kinsey has directed the ordnance operations of the company since prior to World War I.

Robert E. Legate, Ann Arbor, Mich., is a student in mechanical engineering at the University of Michigan and an outstanding Ordnance R.O.T.C. cadet. Now president of the U. of M. Post of the Association, during the war Mr. Legate served in the South Pacific with the 670th Tank Destroyer Battalion.

A. H. Hobelmann

G. A. Uhlmeyer

Col. T. C. Musgrave

I. A. Kinsey

R. E. Legate

Disperse for Survival

Industry Can Answer the Threat of Atomic Warfare

Gayle W. Arnold

A program of dispersion can be developed around the expansion and obsolescence of plant facilities

THROUGHOUT history people have believed that the best way to protect themselves against a common enemy was to huddle together. Cave dwellers, in times of common danger, instinctively gathered into one cave to multiply their ability to defend themselves.

That concept of strength through unity has persisted through all stages of the development of civilization. It dictated the construction of castles and fortresses, from whose ramparts the defenders could pour boiling oil onto the heads of their attackers. It was carried over into our modern way of living, on the theory that the bigger the city the easier it was to defend.

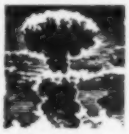
But that concept of concentrated protection was rudely shattered on the morning of August 6, 1945, when the first atomic bomb ever to be used in warfare exploded over Hiroshima. As in the case of all world-shattering events, the full significance of this one has taken some time to sink in.

Deconcentration

In the industrial field we are rapidly learning that all the "boiling oil"—and the thousands of other things that make up the essential equipment of modern armies—cannot be produced within one compact stronghold. In fact, the more the manufacture of military equipment is concentrated the more it becomes a vulnerable target for the enemy, and, consequently, the less able we are to defend ourselves.

Of course, everybody knows that you cannot change the habits of centuries overnight. The machinery of industrial concentration, which has so long been gathering momentum, cannot be expected to grind suddenly to a halt and start moving in the opposite direction. There was a time when it was a fairly simple matter to pick up the tools used in making Minié balls and move on to another spot, but deconcentrating some of our manufacturing behemoths today poses quite a different problem.

We of the National Security Resources Board have been doing some hard thinking about this problem, and we have had the patriotic advice of some of the best industrial brains of the country. We have arrived at some general principles which we believe are sound, practical, and in line with the best economical interests of industry as well as with the welfare and security of the Nation. These principles have been embodied in a publication entitled "National Security Factors in Industrial Location." More than 40,000 copies have been distributed to industrial leaders and to the general public in response to specific requests. I should like to discuss briefly some of the conclusions reached.



The problems of industry location in the atomic age must take into account not only the economics involved but, equally important, the ever-changing concepts of military strategy—envisioning the possibility of attacks of unprecedented magnitude against our more vital centers of production. Thus industry itself has an immense stake in the proper dispersion of its facilities—not from a national-security viewpoint only but to preserve its very existence.

There is no known military defense against the atomic bomb, except space. There is, and will continue to be, defense against any carrier which a potential enemy might use to deliver such a bomb. But this defense alone is not sufficient. The past few months have furnished dramatic proof that the constantly increasing range of aircraft, together with the enormous destructive capacity of atomic weapons, makes reasonable the assumption that within the foreseeable future no area in the United States will be immune from possible attack solely because of its location.

Attractive Targets

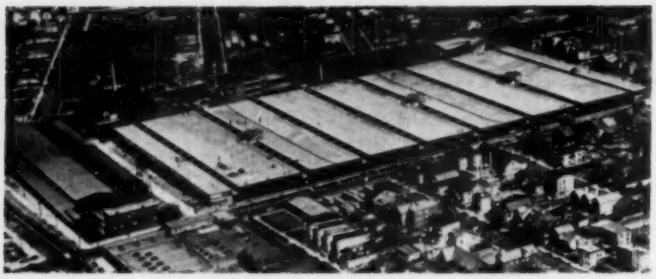
This proved concept, coupled with the knowledge that the destruction or immobilization of a nation's vital industry will destroy its capacity to defend itself, indicates that highly concentrated areas of industry and population will be the most attractive targets. The risk of a sneak or unconventional attack becomes great because of the formidable and possibly decisive advantage which would accrue to a powerful enemy in modern warfare by choosing the time, place, and mode of attack.

The Air Policy Commission sums up today's situation with this cogent comment: "We must assume that if future aggressors have learned anything from World Wars I and II it is that they must never let United States industrial power get under way. They must destroy it at the outset if they are to win."

What could happen in such a case has been graphically described by Dr. R. E. Lapp, executive director of the Committee on Atomic Energy of the Research and Development Board, in an article published in the February 1949 issue of the *Bulletin of the Atomic Scientists*. For purposes of illustration, Dr. Lapp describes the pandemonium, as well as the wiping out of productive potential, that could result from an all-out attack on a typical American city of about one million population. He assumes that one atomic bomb would approximate the destructive capacity of a 50,000-ton high-explosive bomb.

Dr. Lapp's hypothetical city has an essential airplane plant five miles from the center of the city and an equally essential steel mill five miles from the center on the other side. The two thus are far enough apart to make impossible the destruction of both by the same bomb. But a single placement, he contends, in the *middle* of

Mr. Arnold was formerly consultant to the Chief of Ordnance, U. S. Army, and later assistant director, Office of Production, National Security Resources Board. He is manager of industrial development, Baltimore and Ohio Railroad, and consultant to the NSRB.



A perfect example of a plant located in a crowded area surrounded by homes and other plants. Such conditions would be ideal for the bombers of a future enemy.

the city, resulting in 100,000 human casualties, could render both factories impotent because of their dependence upon workers living in the target area. Dr. Lapp, whose ideas do not necessarily coincide with those of the National Military Establishment or of the Atomic Energy Commission, draws a plausible conclusion that one means of passive defense is such long-range planning, coupled with the industrial dispersion recommended by the National Security Resources Board, as would tend to make large American cities unattractive targets.

The relatively prosaic reports of the Bureau of the Census tell us that at the beginning of World War II almost half of our total population, and three-fourths of our urban population, lived in the 140 concentrated urban areas which we call "metropolitan districts." Nearly one-third of our population lived in only 19 districts, each with more than 50,000 population. That sums up in a sentence the locality pattern of our economy, because such concentrations of people also are the concentrations of our industrial plant, our transport facilities, our business management, and our governmental administration.

The fact that 75 per cent of our urban establishment—the key to the functioning of our civilian economy—is concentrated in 140 compact target areas with 45 per cent of it in only 19 of them should give pause, particularly since these metropolitan areas continue to absorb the lion's share of the population increase.

It is significant that had the current annual increase as reported by Census in the 140 metropolitan districts been channeled into a wiser course, the result might have been 15 *new* cities of 50,000 population each and each relatively safe from atomic attack.

An enemy planning to use atomic weapons, with the United States providing the targets, is faced with the very real problem of the number of such atomic weapons available, or to be made available, for use. It is this important basis which enables us to estimate with some degree of assurance the enemy's capacity for destruction. Assuming the enemy has an atomic bomb and the means for delivering it, there remains another basic problem of how many bombs can be made available. Atomic bombs are expensive. The essential fissionable elements are scarce, and production is very costly.

Targets Must Be Assessed

Any aggressor nation must, therefore, assess targets in terms of the amount of fissionable material economically profitable to allocate to their destruction, and each target must be valued in terms of its essentiality to a nation's war-making capacity. The "scarcity" element is further restricted by the addition of expense—in money and men—of delivering the bomb. As the range from base to target increases, the related "pay load" decreases, and the cost of the operation in relation to the damage to be caused becomes greater. If to this be added losses incurred from active interception, it seems logical to assume that in any contemplation of such damage a limited number of targets is basic.

If this be true, it follows that location of industry and population assumes, strategically, major proportions. Further, it is evident that time is of the essence in establishing at least a pattern of location which in its initial concept is strategically sound, and which may be followed consistently.

Today's strategy is based upon the premise that any portion of our Nation is subject to attack; but the staggering cost in material, men, and energy of an attack intended to destroy even partially the productive capacity of the Nation would require great planning to accomplish maximum damage to production facilities and population. Based upon this concept of limited striking power, it is reasonable to assume that no country in the foreseeable future will have enough atomic bombs to permit use of one on any area of industry concentration of less than 5 square miles or on urban concentrations as small as 50,000 people or less when separated by about 10 miles of relatively open country.

Dispersion Is Practical

Any approach to this problem must, in the case of industry, be such that it can be woven into our private system with minimum difficulty. Therefore it must be economically feasible and, in the case of population, must be consistent with the national effort to attain better conditions of living and work.

Dispersion is economically feasible for industry because industry can develop a program of dispersion built around the expansion and obsolescence of plant facilities. Twelve to fourteen billions of dollars are spent annually for new plants and equipment. New sites can be selected which will satisfy security *as well as economic requirements*. Dispersion in terms of the yardsticks described—namely, communities of 50,000 people surrounded by 10 miles of open space—is consistent with current efforts to employ space toward the end of providing better conditions of living and work.

With four decades in transportation, three of them devoted to the problems of plant location, and with presumably adequate awareness of every factor influencing what some people are calling "the migration of industry in the United States," it would be a fallacy indeed for me to stress so definitely the strategic concept of industrial location and dispersion, and at the same time to relegate to the background the economics which inevitably influence plant location. Such is not the intent.

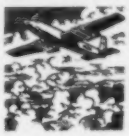
Until the primary and essential factors in appraising any industrial site are resolved in the light of the economics applicable to the particular industry and "add up to the right answer," we may not make one single suggestion about location from the sole standpoint of strategic vulnerability.

The appraisal of the relative strategic position of a plant, employing the guide rules described in the "Industrial Location" brochure, may produce seemingly startling results. If the indication is that the facilities should, in whole or in part, be removed, there is no recommendation or thought that this be attempted at once. To do so probably would constitute a financial problem not consistent with realistic economics and would give rise to many allied problems which necessarily must be resolved. If the industry comes within this category, at least it can avoid further expansion of facilities in its present location where it is vulnerable to enemy attack.

The suggestion of the National Security Resources Board is that industry's efforts be directed to the development of a progressive dispersion plan built around normal expansion and obsolescence factors. Any solution to the problem must be economically feasible and must of necessity fit into long-range planning.

It is a most fortunate coincidence that a city of forty to fifty thousand—which the Board's consultants consider generally too small to present an attractive target for atom bomb attack—is a rather good size for effective social, economic, and political organization. And it is fortunate that separation of such towns by belts of open land that keep them from forming collective targets also provides the space for recreation, food production, manufacturing plants, airfields, express highways, and other features that the component cities of a metropolitan region need for healthy living. A grid of railroads, highways, and utilities laid out to minimize chances of disruption by air attack is also needed to knit a series of dispersed urban units into an effectively functioning area.

I want to repeat: Studies to date indicate that areas of industry concentration of less than 5 square miles or urban concentrations of less than 50,000 population when separated by about 10 miles of relatively open country may be assumed reasonably secure from attack under all circumstances expected to prevail. While such an outlook tends to oversimplify the problem, it can lead to thinking in terms of the probable growth or foreseeable developments in the area which later may make it strategically vulnerable.



Underground Construction

Underground installations, even though possibly providing maximum protection, are not deemed practical for application on a major scale. The generally higher construction costs are only one of the objections to be met. Resort to this type of installation probably would be economically justifiable only in connection with such highly strategic facilities as may be determined by duly constituted authority.

We may take some comfort from the fact that decentralization of population and industry actually is taking place. The recent release of the National Industrial Conference Board, titled "Decentralization of Industry," shows that already: "There is a trend toward locating manufacturing plants in the smaller cities and towns—10,000 to 100,000 population being most popular for plants established 1940-1947. Subsequent to 1940 the percentage of plants established in cities of 100,000 or over has dropped from 47 per cent to 34.3 per cent. At the same time, since 1940 the percentage of plants established in cities of 100,000 or less has risen from 53 per cent to 66 per cent." The dispersion or decentralization is particularly notable in certain classes of industry, of which chemicals and electrical appliances are only two.

A business weekly of national importance, commenting on the problem, summarizes the recommendations of the National Security Resources Board by stating that:

"Safest wartime sites for factories are areas with these qualifications: (1) away from other plants, (2) away from big cities, (3) in hilly country, (4) away from military installations, (5) away from dams or power plants."

Notwithstanding the fact that two-thirds of our productive capacity, two-thirds of the value of commodities produced, and two-thirds of our man power in industry are in the territory roughly east of the Mississippi and north of the Ohio and Potomac Rivers, *dispersion* as herein invoked does not mean *relocation* from one part of the country to another. It has been said that in the valleys, mountains, and hills of New England *all* industry in the United States could be located and at the same time meet the requirements of strategic safety as conceived herein.

Relocation Not Necessary

Whether or not that be a fact, there is no thought that industry must be picked up bodily from its present location, wherever that may be, and transported to the mountains or the desert. I repeat most emphatically that the approach is one of obsolescence and expansion leading to the construction of new plant facilities.

The job of dispersion is one that industry must assume, both for its own protection and that of the national security. Ours being a democratic nation, dedicated to the principle of free enterprise, the Government can neither dictate nor finance such a large-scale change in the industrial pattern. While the Government naturally is concerned with the promotion of a healthy condition in private enterprise, it also has a primary concern for the security of the Nation as a whole.

If the industrial facilities of the United States were effectively dispersed, that fact alone would make an incalculable contribution toward the maintenance of peace because of the prohibitive expense of any enemy attempt to destroy this country's ability to defend itself. Dispersion can contribute significantly toward outlawing war.

Fairchild Aerial Surveys, Inc.

This plant, located in hilly country away from large urban centers, would be secure against the only logical use of the atom bomb—the destruction of congested areas.

Navy photo

Naval Ordnance Laboratory

Expanding Facilities for Research at White Oak

by

Lieut. Comdr. B. L. Britton, U.S.N.R.

With the ever-increasing emphasis on science in war, the Laboratory is assuming a greater importance to our Naval Establishment

OF the many lessons learned by the U.S. armed forces in World War II, none has been driven home more forcefully than that of preparedness. Caught off base as we were at Pearl Harbor, the Nation is determined that never again will we be so woefully unprepared.

As an earnest of these intentions, we have begun to build our armed services back to a "reasonable posture" of strength. Perhaps of even greater importance, we have set up a number of weapons research and development projects. Taught by the discovery of the atom bomb that science can play a valuable—perhaps decisive—part in warfare, we are striving now to get behind us sufficient research to be translatable immediately into new weapons in the event of future hostilities.

Some of this research is being done by private industry or by universities. But since much ordnance development is of use only to the armed forces, with no industrial application, a large part of it has been placed in the hands of the services themselves. Accordingly, many of the Nation's top scientists today are working under the administrative direction of men in uniform.

An outstanding example of the way this tremendous job is being handled is the new $35,000,000 Naval Ordnance Laboratory, located just north of Washington at White Oak, Md. Here, on 938 acres of wooded, rolling countryside, are the varied facilities required to handle the work program of the Bureau of Ordnance which includes everything from mines to guided missiles. The big installation is expected to be complete this fall.

Early Beginnings

The laboratory at White Oak, which already includes nearly one hundred buildings, is the culmination of a small beginning at the Washington Navy Yard in 1920. At that time, following the success of the mine barrage during the first World War, work was begun on mine development in one small building within the yard. Later, work on fuzes was transferred to this building, which in 1929 was given the official title of "Naval Ordnance Laboratory."

First Big Job

The laboratory within the yard progressed unspectacularly, and with meager financial support, until early in World War II. As late as 1940 its total staff was less than fifty persons. Then came its first big special job: the development of degaussing for the U.S. Navy and merchant marine, based on practical British experience. In conjunction, work on influence fuzes for mines was continued, and late in the war this led to a similar program on influence exploders for torpedoes. Development of contact fuzes for shells also went on and was expanded as the war enveloped the United States.

With the prospect that such expansion would continue even after the close of hostilities, it was only natural that the cramped NOL organization should seek new space. It was also natural that, as an establishment for research and development, it should seek separation from the Navy Yard which was placing increasing emphasis on the production aspects of ordnance work. In November 1943 a formal request for a separate plant was made. Initial planning got under way almost at once, and

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construction was actually begun in 1944.

The planners chose a location in the Washington area because it was considered desirable for the laboratory to be close to the Bureau of Ordnance. It was far enough beyond the city to provide land both for the laboratory and for the housing of its staff. Proximity to a center of intellectual activity weighed heavily in making the final choice, so that employees might complete advanced scientific and engineering study in conjunction with their work. This was also intended to encourage participation in the activities of various scientific societies, since the Navy realized any good scientist would wish to further his standing in his own profession.

Specialized Facilities

From its original limited field of underwater ordnance, NOL has gradually branched out to take in weapons of all types. This calls for a number of specialized buildings and facilities at White Oak. Besides the central laboratory structure, which also houses the administrative offices, these include a large environmental laboratory designed especially for heavy test equipment, a model shop, a plastics laboratory, an extensive X-ray laboratory, a building designed for work on experimental ammunition, a group of nonmagnetic buildings for measurement of terrestrial magnetism, specially constructed buildings housing the supersonic wind tunnels, ballistics ranges, and an explosives area which contains a number of small laboratory structures.

The main building—actually four buildings constructed to appear essentially as one—is a hollow rectangle in plan, affording plenty of natural light for all laboratory and office spaces. The entire front wing is devoted to administrative offices, while the remaining wings contain small laboratories of all types. The steel partitioning used throughout the building is movable, so that working spaces may be adjusted to fit desired needs. Alternating and direct electrical current, hot and cold water, compressed air, gas, and steam are provided in shafts at 22-foot intervals.

A fifth building, at the rear of this rectangle and connected to it, contains the cafeteria, an auditorium large enough to seat the entire technical staff, and air-conditioning units for the group. The auditorium is completely equipped with film projectors, sound equipment, and all the paraphernalia needed for holding scientific symposia.

An item of major interest at White Oak is the aëroballistics area which centers around buildings housing the captured German supersonic wind tunnels. These two 40- by 40-centimeter wind tunnels, captured intact at the end of World War II in Kochel, Bavaria, were originally set up at the German research institute in Peenemunde, and with them the Germans perfected the V-2 rocket later loosed against England. At White Oak the tunnels have been modernized and reërected with a new American-built vacuum sphere fifty-two feet in diameter and are operated intermittently for periods of about forty seconds at a time.

In these tunnels air flow around stationary models of rockets and missiles at supersonic speeds is attained. Late in 1948, NOL technicians achieved in the Kochel tunnels a new world record of Mach 5.18—5.18 times the speed of sound. By using the data obtained in such tests, stresses and strains imposed on missiles of varying shapes at simulated high speeds can be determined in the planning stages.

Two ballistics ranges are set up in close proximity to the wind tunnels for free-flight testing of models up to 40 millimeters in diameter. The larger range is 450 feet long and 20 feet square; the smaller is 300 feet long and is provided with a pressure tube 36 inches in diameter. In the latter, pressures ranging from a few millimeters of mercury to six atmospheres can be simulated. Flash photographic stations are set up in each range to record the behavior of models in flight.

Magnetics Area

In the magnetics area at White Oak, Navy scientists can reproduce the magnetic field encountered in any part of the earth and superimpose upon it the signature of any ship at any speed. The various coil shapes necessary to do this are housed in seven buildings surrounding a central preparation building, which holds the batteries and amplidynes for energizing these coils.

Materials used in construction of buildings in the magnetics area were carefully selected for their nonmagnetic properties. Iron and steel were entirely eliminated. Nails used are made of copper, light switches of porcelain, drains of transite, and building beams of wood. Even the sand used in the bricks was screened for removal of iron-oxide particles.

NOL's X-ray laboratory is one of the most complete experimental stations of its type in the country. Its equipment ranges from conventional 150-kilovolt X-ray generators to a 10-million-volt betatron, the first mobile machine of its type in the world. The betatron is capable of penetrating sixteen inches of steel in making shadowgraph pictures of internal ordnance assemblies. To protect workers from radiation, it is surrounded on three sides by 32-inch walls of reënforced concrete. On the fourth side is an open court—kept clear of personnel during operation of the big generator—and a hillside into which radiation may be dissipated harmlessly. An elaborate system of devices is rigged to cut off the machine in case some one should stray into the danger area.

Smaller X-ray machines are housed in individual cubicles with walls of sufficient thickness to permit, in so far as appropriate, simultaneous operation without interference. These walls also offer protection to the working personnel.

The plastics laboratory, a World War II development, specializes in the adaptation of plastic materials to ordnance needs. It contains machinery for compounding plastics, high- and low-pressure molding equipment, curing ovens, and measuring and testing equipment.

The explosives area at NOL is designed for research on explosives in small quantities—up to five pounds. Two bombproof buildings are already in existence here, with control rooms and other auxiliary equipment, and still others are projected. Facilities for mixing explosives, for measuring air blasts, for studying under any atmospheric condition the durability of such ordnance components as detonators, boosters, and fuzes are all available. A 75-foot steel drop tower is used to test the safety of unarmed fuzes under impact, and the shocks of impact and setback may be simulated by use of a shock tower.

The model shop, which covers an area 450 feet by 160 feet, is well equipped with modern metalworking and woodworking machinery. Most

mechanical operations necessary on weapons as large as mines and torpedoes can be carried out there. About 400 craftsmen work in this shop on one shift.

Environmental Laboratory

Last major building still under construction at White Oak is the environmental laboratory which will house a variety of elaborate equipment for measuring ordnance components and testing the materials that go into them. By means of a chamber large enough to hold a miniature one-man submarine, pressure may be applied to full-size weapons for the purpose of testing phases of their static performance at great depths. High- and low-temperature rooms are provided. There is assorted equipment for determining the effect of small shocks, jiggling, or vibration normally encountered in the transportation of ordnance equipment.

This building will also house "air guns" in four different sizes for use in shock testing. Small components, such as fuzes, may be accelerated in these guns up to about 30,000 times that of gravity. Larger components, such as mine-firing devices, may be accelerated up to about 2,000 times that of gravity.

One of the outstanding facilities still to be completed at White Oak is the anechoic room, located in one wing of the Administration and Main Laboratory Building. Three stories high, the room is in the form of a cube fifty feet on an edge and will be equipped with the most modern sound-absorbing equipment to make it nearly one hundred per cent echoproof. In this "dead" room, basic acoustic measurements may be made both in the air and on microphones and transducers.

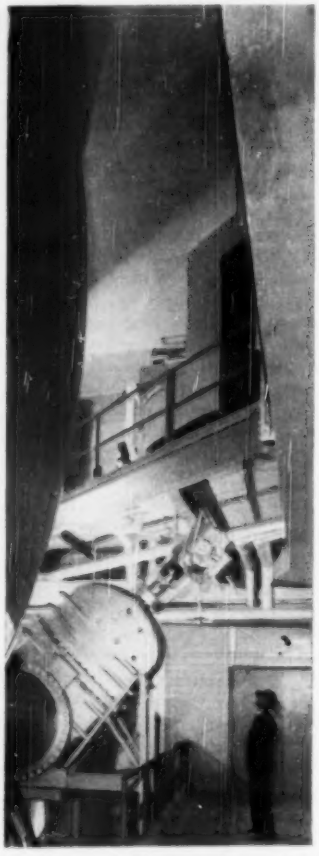
Aside from the central establishment at White Oak, the Naval Ordnance Laboratory administers four different test facilities along the Atlantic seaboard. General testing of all types of mines is carried out in shallow water at the Naval Mine Test Facility on the Chesapeake Bay at Solomons, Md. A countermining range is also available at Solomons, as well as limited facilities for testing experimental torpedoes. With the coöperation of the near-by Patuxent Naval Air Test Center, drop tests from aircraft also may be made.

At Hiwassee, N. C., is an NOL facility for the partial testing of some antisubmarine weapons. Here the reservoir of one of the TVA dams forms a range with water depths up to 250 feet. A number of targets are available here for simulating the fields of submarines, and a recovery net catches and retrieves weapons fired into the water.

A rough-water range, recently transferred from Provincetown, Mass., to Cape Henry, Va., at the entrance to Chesapeake Bay—will be consolidated with fire-control test gear at the Army's near-by Fort Story and jointly administered by the Army and Navy.

Mine-Actuation Range

In the same area, at Fort Monroe, Va., NOL operates jointly with the Army a mine-actuation range, over which passes the heavy traffic of the Norfolk ship channel. Here, Army minelayers place mines on the bottom and connect them to a cable network.



A velocity of 5.18 times the speed of sound has been attained in the Lab's wind tunnel captured from the Germans.

In addition to these four facilities, NOL's technical staff also has access to a number of other naval testing establishments such as the proving ground at Dahlgren, Va.; the guided-missile and aircraft ranges at the Naval Ordnance Test Station, Inyokern, Calif.; the underwater torpedo range at Morris Dam, Calif.; and the Submarine Countermeasures Laboratory at Panama City, Fla.

The whole elaborate setup of the Naval Ordnance Laboratory represents something of a new departure in naval establishments. In setting up both this laboratory and its twin station on the West Coast at Inyokern, the Bureau of Ordnance placed the work to be done on a professional basis. That is, the research and development work is done by professional scientific and technical people, with professional Naval officers serving in administrative capacities.

Laboratory Commander

To serve as commander of the huge new laboratory, the Navy chose for the first time a flag officer—Rear Adm. Frank E. Beatty, a combat veteran who is also a trained engineer. Admiral Beatty, in addition to his training at the Naval Academy, holds a B.S. in mechanical engineering from the Massachusetts Institute of Technology. He is familiar with NOL problems from a previous tour of duty as officer in charge of the laboratory from May 1931 to May 1933. At that time he held the rank of lieutenant commander.

During World War II, Admiral Beatty saw extensive combat service and, while commanding officer of the cruiser COLUMBIA, was awarded the Navy Cross for heroism in connection with early fighting in the Solomons.

Sharing the leadership of NOL with Admiral Beatty is the laboratory's top scientist, Dr. Ralph D. Bennett, who holds the title of technical director. A physicist and electrical engineer by profession, Dr. Bennett is a former M.I.T. professor who is widely known as an expert in the measurement of cosmic rays. He also holds a commission in the rank of captain in the Naval Reserve.

With the facilities already available at the laboratory and with the fine spirit of teamwork which is developing between scientists and their naval coworkers, there is every indication that exceptionally outstanding results in the field of ordnance will be achieved.

Ordnance Rebuilds and Saves

The Reclamation of Automotive Matériel in Germany

American ingenuity and German labor have effected huge economies in making worn Army vehicles and automotive equipment serviceable for future use

ARMY Ordnance installations in the United States Zone of Germany have rebuilt and reclaimed vehicles, engines, tools, tires and miscellaneous machine parts having a total estimated original cost of more than $110,000,000 in the past two years.

Cost of replacing this equipment at present prices is estimated at $220,000,000. Restoration was accomplished at an expenditure of approximately $35,000,000, including $5,250,000 for American materials and $29,750,000 for German labor and German materials.

Working with stocks of American war materials that remained in Germany after substantial quantities had been shipped back to the United States or transferred to allies through the Office of Foreign Liquidation, Ordnance shops in United States-occupied Germany rebuilt nearly 38,000 vehicles and trailers of all types in the 2-year period ending April 1, 1949.

In addition, some 300,000 tires, 93,000 tubes, and thousands of engines, transmission assemblies, axles, and other automotive parts and Ordnance supply items were rebuilt, reclaimed, and returned to depot stocks in serviceable condition, according to a report by Brig. Gen. E. E. MacMorland, Chief Ordnance Officer, Headquarters, European Command.

Airlift Aided

The contribution of the huge "rebuild" program in support of the Berlin Airlift and its benefits to the German economy are also cited in the report. From reserve stocks of tractors, trailers, and automotive parts supplied by the program, Ordnance outfits were able to reëquip or replace without delay the more than 1,000 Air Force vehicles and truck-tractors and trucks of seven heavy truck companies engaged in out-loading at the Rhine-Main and Weisbaden airfields and off-loading at the Berlin terminus.

"The work of Army Ordnance units in performing major maintenance on these vehicles and making replacements available as needed was an outstanding factor in making possible the around-the-clock, seven-days-a-week operation of the Airlift," Maj. Gen. Charles L. Bolte, Director of Plans and Operations, Army General Staff, stated.

At a period when German industry was virtually at a standstill, establishment of Ordnance rebuild shops at various inactive German industrial installations was the initial means of restoring many plants to production for eventual civilian use. Tools, materials, and other needed assistance provided by Army Ordnance launched production for Army use.

By organizing management personnel, employing skilled technicians and mechanics, and reorienting engine and automobile production workers to post-war types of production, the groundwork was laid for the time when materials became available for operation of these plants in the German peacetime economy. A contribution to German employment was achieved.

Among important plants utilized in this program are the Opel plant in Russelsheim, near Frankfurt, and the Mercedes-Benz plant in Stuttgart. Still in use is the former Bayern Motor Werke plant, near Munich. Now operated as the Karlsfeld Ordnance Center, this plant rebuilds 2½-ton trucks as well as engines and transmission assemblies. As rapidly as practicable, activities at the plants are being transferred to Army shops to release civilian facilities to German production.

About 15,000 German employees are currently engaged in vehicle rebuilding. This number is being reduced as German industry and management become able to give workers direct employment and to perform services for the Army on a quasi-contractual basis while producing items for the country's economy.

Ordnance Department shops in U.S.-occupied Germany have rebuilt nearly 38,000 vehicles and trailers of all types in the last two years. Also, more than 300,000 tires, 93,000 tubes, and thousands of engines, transmissions, axles, and automotive parts were rebuilt and returned to depot stocks in serviceable condition.

Original cost of this equipment has been estimated at $110,000,000 and its present-day replacement value at $220,000,000. Restoration cost was approximately $35,000,000, including $5,250,000 for American materials and $29,750,000 for German labor and materials.

Costs of Rebuilding

The cost of rebuilding military vehicles in Ordnance shops varies from twenty to sixty per cent of acquisition costs. Typical of those cited in the report are costs for the quarter-ton "jeep" and the 2½-ton, 6x6 truck, known as the "workhorse of the Army." Under wartime procurement, the average cost of a jeep was $1,051. It is now being rebuilt in Germany for about $690. The "six-by-six" truck, with an average wartime cost of $2,850, has a present rebuild cost of $1,120. These costs are decreasing progressively with improvement in operating methods and personnel utilization.

Rebuild methods produce what is, for practical purposes, a new vehicle. All vehicles are stripped to component parts and then reassembled to the last rivet.

In addition to Karlsfeld Ordnance Center, Army installations at which this recovery work is being carried on include Ordnance rebuild shops at Esslingen, Boeblingen, Kassel, Schwaebish Gmuend, Aalen, and Butzbach. At a tire-reconstruction plant at Ober Ramstadt, approximately 17,000 used tires and 7,500 tubes are made serviceable each month. A picture-story of some of these operations is featured on the next two pages.

ORDNANCE WARS AGAI

A skilled German employee turns out a spare part for a valve on an oxygen tank. He is one of 1,850 workers employed at a large U.S. Ordnance center in Mannheim, Germany.

A jeep repair line in Ober Ursel. Army vehicles of all kinds were r

An employee at Mannheim inspects a spare part for rust after cleaning.

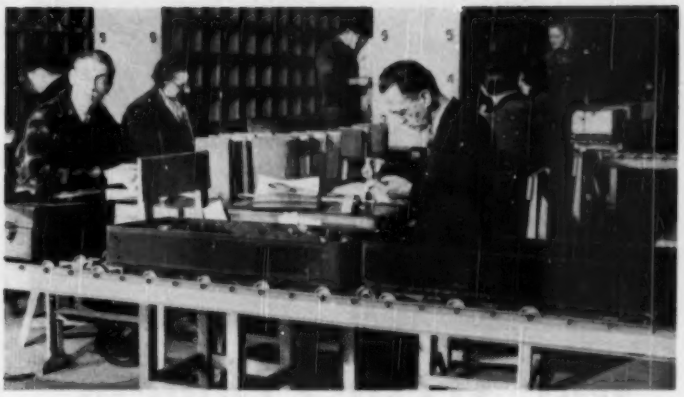
A civilian technician inspects repaired gauges and welding equipment.

An Army enlisted technician checks a is reprocessed at the Ordnance Tire and

Reconditioned tires are inspected as th stadt. This plant restores to use each

ST WASTE IN GERMANY

ing the past 2 years, almost 38,000
lt in the U.S. Zone of Occupation.



German employees at the Mannheim Ordnance Center are classifying tools and spare parts for repair, storage, and reissue to American units stationed in the U.S. Occupation Zone.

e for cuts and broken places before it
build Shop at Ober Ramstadt, Germany.

Tools and spare engine parts which were discarded or gathered from deactivated units are being repaired by civilians at the Mannheim Ordnance Center.

come out of tire molds at Ober Ram-
nth about 17,000 tires and 7,500 tubes.

A welder repairs a metal item at the Mannheim Ordnance Reclamation Center where much of the disabled matériel of the war in Europe is reclaimed (Army photos).

Army photo

Our Arctic Problem

Combat in Polar Areas Poses Urgent Questions Requiring Early Answers

by

Lieut. Col. Roy E. Moore

Has the defense of our northern continental back door in Alaska been sufficiently developed?

IT is well known that the shortest distance between the great land masses of the Northern Hemisphere is through the arctic regions. The term "arctic" has been variously defined (1) as the area between the Arctic Circle and the North Pole, (2) the area north of the tree line, and (3) the area lying north of the 50-degree isotherm. As used throughout this article it applies broadly to those areas of the far north beyond or on the fringe of the present web of surface transportation.

Colonel Moore is attached to the Student Detachment, Armed Forces Staff College, Norfolk, Va.

Aircraft based in arctic areas are within striking distance of the economic nerve centers of the world. These are facts which in recent years have caused us to become increasingly conscious of our "northern flank." Without air superiority, our northern regions would be indefensible. However, regardless of the degree of air superiority in any region, arctic or otherwise, there always exists a strong possibility that the bases from which the Air Force operates either will have to be defended by ground troops against enemy ground or airborne attack, or recaptured after seizure by a hostile force.

Of all the arctic regions in which we have an active military interest, Alaska is the most vulnerable. The loss of our bases in Alaska to an aggressive enemy determined to hold them would be a national crisis of the first magnitude. The amount of time, money, and men necessary to mount a major counter-offensive in Alaska could well be more than we could afford, particularly with the enemy occupying air bases within easy reach of our industrial centers using present-day airplanes. Col. Billy Mitchell in his oft-quoted statement—"Who holds Alaska, holds the world"—could well have been entirely right.

In view of the strategic importance of Alaska, several questions naturally arise such as: "What ground combat units should we have in Alaska?" "What would be the probable nature of a ground campaign in Alaska?" "What are we doing to prepare for the ground defense of Alaska?"

The answer to the first question—"What ground combat units should we have in Alaska?"—was clearly answered by Gen. J. Lawton Collins when he said: "Without adequate defensive ground forces in Alaska an enemy might, by surprise attack, seize bases there from which it would be extremely difficult to dislodge him."

In order to understand the probable nature of a ground campaign in Alaska it is necessary to have at least a general understanding of the country itself—its weather, its terrain, and its transportation system.

Arctic Weather

Considering the weather picture briefly, the temperature is highly variable from year to year, from place to place, and from time to time in the same year and place throughout Alaska. At Fairbanks, for example, in the east central portion, the temperature throughout the winter months may be said to vary roughly from seventy degrees above zero to seventy degrees below zero Fahrenheit.

Likewise, snowfall, snow depth, and types of snow will vary throughout Alaska from the hard, crusty, wind-packed snow of the northern and western coasts, to several feet of deep powdery snow in central Alaska, and to but a few inches or no snow at all in still other localities.

The terrain of Alaska is extensively mountainous, with the high rugged Alaska Range in the south extending from the Rockies out into the Aleutian Islands, and the bleak, desolate Brooks Range extending across most of northern Alaska. Between these two ranges is a plateau drained by the Yukon River and dotted with innumerable small lakes and swamps. The boggy nature of the lowlands and the ruggedness of the mountains make most of Alaska all but impassable to foot troops during the summer months and extremely difficult to traverse during the winter months.

Perhaps the most discouraging feature of all to the ground-combat planner is the utter lack of roads throughout

Alaska. With the exception of the Alaska Highway, which traverses Canada and terminates at Fairbanks, and the Richardson Highway from Fairbanks to Anchorage, there are no roads worthy of the name in the entire territory. All travel and supply to the numerous outlying airfields and civilian communities must necessarily be by water or air in the summer months and by "cat trail" or air in the winter months.

A military operation in Alaska, then, might be compared to the island hopping of the recent Pacific war, with the airplane rather than the ship as the principal mode of transportation and isolated airfields rather than islands as the objectives.

The number of "island airfields" which could be taken by the airborne forces of an aggressor nation in one hop would depend on a number of factors. It would depend, first, on the extent of the area over which he could reasonably expect to establish air superiority. This, in turn, would depend to a large extent on his ability to incapacitate our three major airfields—Ladd, Eielson, and Elmendorff fields—by atomic or other means.

Not the least of the numerous factors to be considered would be the strength of the ground defenses at the objective airfields. Considering this last factor from a defensive point of view it would obviously be uneconomical, if not impossible, to maintain large numbers of troops at all the numerous airfields in Alaska in anticipation of attack.

However, it does not appear to be either uneconomical or impossible during these years (or months) of peace, to strengthen the physical ground defenses of these fields by means of antiaircraft guns, tanks, Weasels, pillboxes, underground shelters, ammunition, demolitions, medical supplies, and the host of other items which would make the task of an aggressor airborne force many times more difficult and the task of defending and supplying these fields a hundred times easier in the event of an emergency.

What of Our Ground Defenses?

"What are we doing to prepare for the ground defense of Alaska?" During the winter of 1946-1947, exercises were held both in Alaska and in the northern part of the United States primarily for the purpose of determining the effect of various types of cold

The M29C Weasel can tow light loads over snow, such as a ski-fitted wheeled trailer.

weather on military matériel. The results of these "Frigid," "Frost," and "Williwaw" tests have been rather widely disseminated and are either well known or readily available to those interested in arctic operations. The fact that these tests were primarily concerned with the very tangible subject of matériel tended to make results more conclusive than those of subsequent tests which dealt with less tangible matters.

One of these subsequent tests which may not be widely known but which should be of great value in planning future ground combat exercises or actual operations in the arctic was Exercise Yukon, conducted by elements of the 2nd Infantry Division during the winter of 1947-1948. Exercise Yukon was designed to find out what special training, indoctrination, and equipment are necessary for ground combat in Alaska and whether a group of nonselected, run-of-the-mill American soldiers, after a reasonable period of training and acclimatization, can be self-sufficient and still have time and energy left to fight or carry out a mission under the rigors of an arctic winter.

Preparations for the exercise were initiated during the summer of 1947. Limitations on the amount of air transport and on facilities available in Alaska made it necessary to limit the number of troops participating in any one exercise to approximately 250. Accordingly, four rifle companies, each reënforced with different arms and services of the division, were organized for successive exercises in Alaska throughout the winter. These four augmented companies were designated Ucon Companies A, B, C, and D.

By varying the reënforcing element with each of the four companies it was possible to include every major arm or service of the division in at least one of the four exercises. Furthermore, by spreading the exercises throughout all the winter months it was felt that a wide variance in weather conditions would be encountered.

The pre-arctic training of the Ucon Companies was divided into three principal phases: An air-transportability phase; a pre-arctic schools phase; and an acclimatization phase.

Upon completion of the air-transportability phase of training, the pre-arctic schools phase was begun. Subjects taught during this phase were: Repair of skis and snowshoes; winterization of ordnance, signal, and engineer equipment; and care and use of arctic clothing and equipment.

Acclimatization

The acclimatization phase of training, conducted on the slopes of Mt. Rainier, Wash., was for the purpose of concentrating on those subjects necessary for survival in the arctic and to accustom the men to living and fighting under severe weather conditions. Men were formed into 4- or 5-man tent teams and taught to live and work as a team. Although the weather was wet and cold in the Mt. Rainier area as compared with the dry cold of most parts of Alaska, nevertheless the acclimatization training proved to be very valuable in reducing weather casualties to a minimum during the later exercises in Alaska.

On November 1, 1947, the first of the four Ucon Companies took off for Big Delta, Alaska, the base from which further operations were conducted, and on March 5, 1948, the last of the companies closed into McChord Field, Wash., at the completion of Exercise Yukon. During the exercise, each company con-

The lightweight pyramidal tent heated by a stove adequately sheltered 4 or 5 men.

ducted shakedown maneuvers in the vicinity of Big Delta, after which it was alerted for air movement to one of the outlying airfields in western Alaska.

The fields to be defended were varied in successive exercises, but the tactical situation was essentially the same in each case. Briefly, the tactical situation called for the defense of each field against threatened airborne attack, followed by a reversal of the situation in which the company was moved a short distance away from the field where it was assumed to have been dropped and given the mission of recapturing the field.

One of the first things that comes to mind when the arctic is mentioned is the effect of deep snow and extreme cold on the living habits of individuals. Special clothing must be worn to prevent rapid loss of body heat. At the same time this clothing must be capable of being adjusted to prevent sweating while working and subsequent discomfort or possible frost injury.

Troops are unable to work or fight outdoors in extremely low temperatures for protracted periods, and heated shelter must be provided for all members of a force. Food must be kept warm for troops in the field or a means provided for heating it. The only water supply will often be melted snow.

The work capacity of all personnel is reduced in the arctic. Much of the time of individuals is taken up by the details of their personal life. Each trip to the latrine becomes something of a major operation. Arctic clothing is bulky and, by its nature, tends to impede work. A minor adjustment or repair on a mechanism which could be performed in five minutes with bare hands may require twenty or twenty-five minutes with mittens, unless the particular mechanism was specifically designed with an eye toward arctic maintenance and repair.

The effect of the arctic on service and supply is no less than on other aspects of military operations. As much as fifty per cent additional food must be provided because of the increased expenditure of body heat and energy under the invigorating effect of cold weather. The consumption of fuel is likewise increased, not only because of the necessity of providing heated shelters but because of the increased consumption by motor vehicles.

The protection of personnel casualties from the elements becomes a vital necessity in the arctic. Although this problem did not arise to any great extent during Exercise Yukon, it was evident that on a wartime operation of the same type speed in evacuation would be vital. At forty degrees below zero a casualty should not be left in the open for more than ten minutes if he is not to suffer further injury from the elements. Electrically heated evacuation bags and good oversnow transportation, supplemented by helicopters and increased medical personnel with frontline combat units, would seem to be the answer.

Man-hauled sled-toboggans are useful, but better oversnow transport is needed.

The Weasel is versatile but limited to hauling light loads and breaking trail.

If I were to name the one most important lesson learned during Exercise Yukon from a personnel point of view, I would say that it was the fact that arctic warfare will require the most careful and complete planning and training and a stricter code of discipline than most units were accustomed to during World War II. The difficulties then involved in educating soldiers to take proper precautions to prevent trench foot were minor compared with the problems involved in teaching soldiers to live without becoming casualties in the arctic.

Little things, such as failure to shed an outer garment to prevent overheating when working or failure to brush the snow from felt boots when entering a warm shelter, may mean the difference between a fighting soldier and a litter case. Over the long haul of actual warfare in the arctic there will be little that can be done to prevent the soldier who is not basically well disciplined in cold-weather procedure from becoming either an intentional or unintentional weather casualty.

Better Snow Vehicles Needed

If I were asked to point out the most urgent need in the matter of equipment as a result of observations during Exercise Yukon, it would be the need for better oversnow transportation. For situations requiring movement on foot, the ski and the snowshoe are excellent. For observation, flank protection, and evacuation, the helicopter and the liaison plane have a vital rôle to play. For transporting individual and small-group equipment, the present sled-toboggan with 3-man harness is good under certain conditions.

The vehicle M29C (Weasel) is also excellent for certain tasks, such as transporting small groups of personnel on reconnaissance or patrol missions, transporting limited quantities of supplies, towing light loads, and breaking trail through deep snow. Its use is limited, however, by its size, interior arrangement, and inability to tow heavy loads, such as artillery pieces. Bridging the gap between assault elements—which will operate primarily with skis, snowshoes, and light toboggans—and the fixed or semifixed shelters in rear areas, there is a need for track-laying vehicles with good oversnow performance which can be used for some or all of the following purposes: mobile command posts, fire-direction centers, radio stations, aid stations, kitchens, battlefield maintenance, prime movers, and personnel carriers to increase the mobility of dismounted units before commitment.

Based upon Exercise Yukon and other arctic exercises conducted in the past and planned for the future, it appears that the answer to the question, "What are we doing to prepare for the ground defense of Alaska," is this: We are doing everything possible with the means available and within the limits of budgetary allowances. Considering the stakes involved, there is one question still to be answered—"Is it enough?"

Research and Materials

Science Discovers New Substitutes for Scarce Stocks

by

George S. Brady

"Nature supplies the material. Art works on it. Art can do nothing without the material; yet the material without art has little value."—*Quintilianus.*

IN the January-February 1949 issue of ORDNANCE, A. R. Glancy presented an article on research with the theme, "The Laboratory Sets the Pace for Industrial Mobilization." From his practical experience in the war effort of 1940-1945 he showed how, in spite of all the planning of the intervening years, we were inclined to begin World War II as a continuation of World War I.

One thing that should have been learned from the last war is that design changes are now so rapid that it does not pay to build great quantities of equipment ahead and that we need live research and healthy production plans rather than a large stock of equipment which would soon be obsolete. The same principle applies to the raw materials from which we produce our industrial-military equipment.

Progress Is Geometric

The rate of progress of technical research on industrial materials is geometric—each new discovery opening avenues to many more discoveries. We made postwar plans and we devised laws based on the war experience, but the ideas of 1945 are rapidly becoming obsolete. In the consideration of the raw materials for a possible emergency we must be careful that we do not tie ourselves to plans based on the last war lest we find ourselves weighted down with a burden of old customs and uses hard to throw off.

It has always been difficult to sell new technical ideas against the mental fixation of old experience. Human nature has not changed in this respect since the beginning of mechanization. But the time element has changed, and to achieve mobilization today changes must be made in days or months that in former times could be done safely in years.

Investment in producing plants is so great today that it is often difficult to make basic changes unless forced by circumstances. For example, another emergency will call for enormous increases in the quantity of aluminum for transportation equipment. But, because we already have plants to produce competitive materials, it is not likely that in peacetime the necessary power plants and aluminum-reduction plants will be built.

Looking back into history we can see how little our human reactions have changed. One of the early industrial-mobilization orders is the requisition placed by Richard II in 1378 on one Thomas of Norwich for two large and two lesser cannons, 600 stones for same, 300 pounds of saltpeter, 100 pounds of sulphur and willow charcoal. (That order was probably as important historically as the Stokes mortars which Churchill paid for out of his own pocket in World War I or the provision for the fast Spitfires that were so superior to the greater force of German planes in 1940.) And Richard apparently had the usual opposition. His father, the Black Prince, had provided four Moorish *wooden* cannon at Crécy in 1346, but the powder charge had to be weak and the stones only rolled along the ground. A little research could have improved the cannon, but experts of that day had revived the Roman stone-throwing catapults, and the type used at Stirling Castle which could throw a 300-pound stone was the ideal of those who could not visualize the possibilities of cannon.

But in the century following 1378, factory mobilization became necessary. For the Moorish wars, Isabella of Spain had many agents in Germany and Flanders contracting for arquebuses to be fired from the shoulder, and the cannon, or lombards, which she obtained from Lombardy workshops, were made of iron bars twelve feet long strapped together with iron hoops.

She had a force of 2,000 mechanics who mounted these on oxcarts and attended them. Gunpowder was no longer mixed by the army but came from factories along the Rhine. The cannon balls ordered by Isabella in Italy were polished spheres of marble.

The record of Isabella's mobilization difficulties is more detailed than that of the Black Prince and his son. Hernando del Pulgar records in his Chronicle that, "It is amazing that a woman should have been able to accomplish, single-handed and in so little time, by her own judgment and perseverance, what many men and great kings had been unable to do for years." But the chronicles tell us how the 25-year-old woman was able to be so amazing. She surrounded herself with young advisers and with German and Flemish technicians. Her primary task was the same as Mr. Glancy describes for 1940—to break away from inhibitions and stereotyped formulas.

The oak timber and the hemp rope used in the Stirling catapult are still needed for industrial-military mobilization, and in greater amounts than formerly. But the materials basis of war has broadened to include numberless other items, less than a hundred of which have been listed as "strategic."

Colonel Brady, business consultant, raw-materials expert, editor, and author of "Materials Handbook," has been a recent contributor to the AMERICAN ORDNANCE LETTER. His findings and comment will henceforth be published in the issues of ORDNANCE magazine.

Comparing definitions of the term "strategic," we find that they mean "any material the domestic supply of which is not sufficient to meet the demands of equipment production in an emergency." But will a hundred listed materials suffice to build the still undeveloped equipment for a future emergency?

I would not hazard a guess as to how many usable industrial materials there are. My own running files contain data on approximately 8,000 materials. There are some 45,000 different wood samples at the Yale Forestry School, and I know of one case where 300 different woods were examined and tested before one was found that gave just the characteristics desired by the designers of a certain product. There are at least sixty minerals in the United States from which uranium may be obtained when our laboratories devise methods for extraction.

The definition of strategic material hinges on two unknown variables—supply and demand. In estimating future needs, the economic expert multiplies past experience by a "guesstimate" of increase. But the progressive technician does not believe that materials used in future products will be employed in the same way as they were in the arquebuses of Isabella or the antiaircraft guns of 1945. Moreover, he believes that the supply factor can be changed by new methods of extraction. The metal cobalt is an example.

Uses of Cobalt

In the first jet engines of the late war, heat-resistant alloys were used that contained sixty-five per cent cobalt. This caused an excited flurry among requirements men who work on comparative figures. The highest annual figure of the war was arbitrarily increased by a third, although accurate figures were not kept on cobalt consumption, and the high "apparent consumption" included the filling of "pipelines." Conferences were held, and requests went out to foreign producers to increase production, though this would require financing refining plants at mines whose ores would be exhausted in a few years at the increased rate.

A technical analysis, however, showed an entirely different picture. Research engineers were aware that it would be folly to place such heavy dependence on this naturally scarce metal. Laboratories found that they could make satisfactory substitute alloys with as little as twelve per cent of cobalt by adding titanium and other more plentiful materials. Then they asked "Why should the whole massive unit be made of solid heat-resistant alloy when a clad metal would give the same result and reduce the amount of alloy needed?"

Another big use of cobalt was in cutting tools, but for this purpose new forms of tipped tools using a lesser amount of cobalt have been introduced. Also, improvements in magnet alloys and permeability alloys would reduce the amount of cobalt compared with its use in the late war for these purposes. On the supply side, it was known to technicians that Canadian nickel carried from one to three per cent cobalt and that large amounts could be extracted from this source in an emergency. Then again, proved chemical methods of extraction are available which would make it possible to obtain additional quantities of cobalt from domestic ores if the need should arise. Thus it can be seen that "economic studies" of future needs of a strategic material based on past experience can be detrimental to effective mobilization because they anchor the future on the ways of the past.

Many practical examples could be given to show that large stocks of strategic materials are incompatible with the idea of progressive research and that individual judgment and initiative —necessary qualities for success in technical mobilization—are likely to be warped and stagnated by large stocks.

"The rate of progress of technical research on industrial materials is geometric—each new discovery opening avenues to many more discoveries. We made postwar plans and we devised laws based on the war experience, but the ideas of 1945 are rapidly becoming obsolete. In the consideration of the raw materials for a possible emergency we must be careful that we do not tie ourselves to plans based on the last war lest we find ourselves weighted down with a burden of old customs and uses hard to throw off."

It is interesting to review the case of coconut oil, still heavily stocked as a strategic material although the conditions surrounding it have altered greatly since the plans were made.

Coconut Oil

Coconut oil is a good food oil, but it has been valued mostly for making toilet soaps because its high content of lauric and myristic acids gives copious lather. Early in the war some of the oil was split to obtain the lauric, myristic, and caprylic acids, useful in making plastics and plasticizers. Later the War Production Board allocated the oil almost entirely for soap making on the theory that a maximum amount of glycerine would be obtained as a by-product since this oil contains nearly fourteen per cent glycerine. But the need was never pressing, and the soap makers were permitted to leave eight per cent of the glycerine in the soap.

As many new plasticizers became available for various uses, including the lamination of bulletproof glass, and because lauryl alcohol could be made from petroleum, the strategic need for coconut oil dropped to near zero. Since the end of the war, new plants have been installed for the more economical production of glycerine from petroleum and natural gas.

The strategic need for soap itself has now been reduced also because of its increasing displacement for industrial and household use by synthetic detergents made mostly from petroleum. About eighty-three per cent of all crude coconut oil was used for soap making in 1948, and the chief use of the refined oil is for shortenings and margarine. Some soaps and margarine are made with coconut oil, but other excellent products are made without it. Commercial bakeries use the oil for cookies and specialties. Some is also employed in the textile industry, but this is not a strategic need because of the numerous other softeners that can be used for textiles.

Much of the copra from which coconut oil is extracted is obtained from the Philippines, an area from which munitions ships would be returning empty, if war occurred in that area, unless we planned to carry back the copra and other materials. Furthermore, since coconuts grow profusely throughout the Caribbean area, production could be increased greatly in an emergency.

It is also known that millions of tons

of babassu, cohune, and other palm nuts yielding oils almost identical with coconut oil go to waste annually in Brazil and in the Caribbean countries. For competitive trade reasons various objections have been given to the development of these, chiefly the difficulty of cracking the babassu nut and the lack of transportation. But any modern tool shop could solve the cracking-machine problem in short order if it were really urgent, and the building of roads in the semiarid palm areas of Brazil is simply a matter of finance. Another factor that has changed the perspective on coconut oil is that the United States has now become a big producer of soybean oil, which can replace coconut oil for most uses.

Palm oil, as a strategic material, has also sunk into insignificance. Previous to the war we imported an annual average of 320 million pounds. It was soon placed on the strategic list because of its use as a flux in tinplate manufacture. But nearly half of all tinplate is now made electrolytically, requiring no palm oil, and other fluxes are also available.

During World War II sperm oil was considered strategic for use in the lubrication of fine mechanisms. This is a waxy oil that has a cetyl acid combined with an alcohol higher than the glycerine found in most animal and vegetable oils. It thus does not oxidize and gum as do the common oils and has a waxy "oiliness." But, during and since the war, great progress has been made in synthesizing waxes. Also, various "oiliness" agents have been developed, such as cetyl piperidine ricinoleate, which, to a chemist, means that coal tar and the plentiful castor oil can be used as raw materials, thus getting away from antarctic fishing for sperm whales. Nevertheless, to the economist who figures on past statistics without a visualization of what is happening in research, sperm oil and palm oil still remain strategic materials.

Speaking of piperidine, both pepper and pyrethrum are classified as strategic materials for emergency mobilization. Pyrethrum is derived from the flower of a chrysanthemum plant and contains pyrithrin, used as an insecticide for crop control. Pepper contains piperidine and is used for food seasoning. The black pepper listed as strategic is the common flavoring pepper and is not the type normally used in meat packing. This black pepper has also been incorporated into certain insecticides.

"In materials' supply, more than in any other place, is seen the truth of the proverb 'Necessity is the mother of invention.' The greatest technical progress comes when there is a strong need. A too-ample supply is like a fat stomach—it engenders lethargy. We need stocks, but we must be certain that we do not let the stocks obscure our vision of the technical changes of the future."

Here again the laboratories were ahead of the economists in forecasting the future. Piperidine is closely related chemically to the pyridine of coal tar, and it is possible to produce this material from coal. That plainly wipes out the need of natural pepper for farm insecticides. Going further, the laboratories have produced such good substitutes for pyrethrin that strategic planning based on the last war is out of date. In fact, the cyclopentane and pyrethronic acid of pyrethrin are known, and one authority has stated that pyrethrin itself may be made synthetically at less cost than the natural product. Pepper is guarded by a monopoly trade, but it could be grown easily in Latin America.

Quartz Crystals Grown

It would be burdensome to enumerate even a small proportion of the new materials that research has produced since the end of the war, but we must mobilize to take advantage of them. To try to replace the scarce natural quartz crystal used for separating wave lengths in telephone and electronic work five projects were undertaken—all of which have been successful. From the experience in growing crystals, quartz itself has been grown synthetically. Another type of crystal has also been grown on the cubical system which can be flattened by heat and pressure into sheets for radar screens.

As an example of the possible usefulness of the hundreds of thousands of plants available to us, the case of acaroid resin might be cited. This resin is obtained from a small palmlike tree of Australia. Because of its reddish color it had only limited use in varnishes and for blending with shellac. But just before the war the Germans were importing large amounts, and no one seemed to know why they took a fancy to it. Later it was learned that merely treating the resin with nitric acid produced the high explosive, picric acid. One has only to review the scientific files taken from the Germans at the end of the war to realize that, had Germany had the same man power and natural resources that we had, the story of the war of 1939-1945 would have been different. In a future emergency we must rely on science, rather than on stocks representing past custom.

A New Frontier

The possibilities of use of our immense resources of low-grade ores represent a new frontier of science. According to the Bureau of Mines, our Western States have "fabulous" deposits of chromium ores. Present research tendencies point to future developments whereby low-grade ores will be put through continuous chemical processes for the economical extraction of the metals contained. Manganese, for example, can be extracted electrochemically from poor ores, and tungsten can be obtained in quantity from the brines of western alkali plants.

A tendency since the end of the war has been to plan raw-materials supplies for the next emergency in terms of the ideas of the exponents of so-called strategic bombing; *i.e.*, that the outcome of a war can be decided by the bombing of production centers. Applied to our materials' supply, this is interpreted to mean that the lines of communication for raw materials to our factories will be cut by bombers and submarines, and that the materials should therefore be accumulated on our doorstep.

That the doorstep can be bombed more easily than a long line of communication is, however, of lesser importance than the fact that the idea of "putting all the eggs in one basket and guarding the basket" can be an impediment to technical progress. In materials' supply, more than in any other place, is seen the truth of the proverb "Necessity is the mother of invention." The greatest technical progress comes when there is a strong need. A too-ample supply is like a fat stomach—it engenders lethargy. We need stocks, but we must be certain that we do not let the stocks obscure our vision of the technical changes of the future.

Packaging for War

A Vital Operation in the Channels of Supply

by

Lieut. Col. J. W. Schroder

The loss and wastage due to improper packaging of military matériel can seriously threaten the success of combat operations

REPACKAGING was one of the major problems of the services overseas during World War II, and one which was never properly solved. The lack of proper packaging often resulted in critically needed spare parts and equipment reaching the user in such damaged or corroded condition as to be useless.

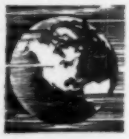
It would seem that a nation with as great an export trade as the United States would have adequate civilian experience to solve the overseas packaging problems of the military forces. However, commercial shipping is done with trained personnel, adequate equipment, and proper storage facilities. Even under these conditions the losses run high.

The Seas Insurance Company, Liverpool, England, has estimated that the total losses on shipments from all ports in the world are running between $600,000,000 and $1,000,000,000 a year. The greatest part of this loss is from pilferage, breakage, and corrosion, most of which is the result of poor packaging.

Contrasted with peacetime conditions, the wartime shipments are made with inadequate equipment, inexperienced labor, and improper storage facilities. Supplies are often unloaded from cargo nets by hoisting one corner and allowing the boxes to tumble out. When a landing craft beaches it is often necessary to unload the supplies through the surf, and after being brought ashore they will probably be stored in the open for long periods of time.

Colonel Schroder is an instructor at the Command and General Staff College, Fort Leavenworth, Kans.

What is commonly spoken of as packaging may more properly be considered under two headings, packaging and packing. However in this discussion the combined operation will be considered as one and the term "packaging" used in the broad sense to include the following: necessary cleaning, preservation, determination of unit quantities per package, protective wrapping, cushioning, and identification marking up to but not including the shipping container, the selection or construction of the shipping container, assembly of items or packages therein together with any necessary blocking, weatherproofing, exterior strapping, and marking of exterior shipping container for identification of content.



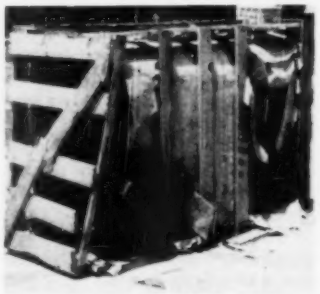
Basic Requirements

It is impossible to establish a single set of specifications for packaging all supplies, since different products must be packaged in different ways, and the conditions under which they will be transported, stored, and used may require variations in packaging. It is, however, possible to establish basic requirements that wartime packaging must meet to be satisfactory. The more important requirements are that a package must be: (1) Strong enough to withstand rough handling; (2) Designed to conserve shipping space and allow the use of materials-handling equipment wherever practical; (3) Limited in weight for those supplies which have to be manhandled; (4) Designed so that they can be opened for inspection or partial issue and then resealed under field conditions; (5) Capable of furnishing adequate protection in storage under severe atmospheric conditions for a minimum of twelve months, including resistance to the effects of intermittent rainfall.

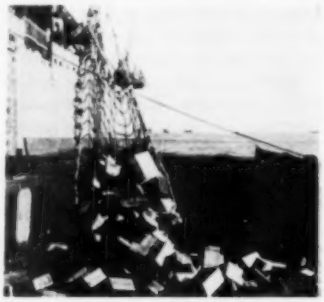
This last requirement assumes great importance when the military operations are in the tropics or the arctic as many of them were in the last war and probably will be in any future war.

At the outset of World War II the packaging specifications contained in the military procurement contracts were generally based on those required by domestic common carriers. It soon became evident that this packaging was not enough for overseas shipments, and research programs were instituted to develop proper packaging materials and methods. In spite of the handicaps of lack of specific information on packaging failures and a reluctance on the part of people in this country to institute the necessary changes, considerable progress was made in this field by the end of the war.

This research is being continued, particularly in the use of plastics for packaging. However, failure to profit by wartime experience and development, coupled with the abnormal conditions of the postwar period, has resulted in commercial export shipping losses far in excess of prewar losses.



This is the result of packing heavy equipment in a crate too light for shipping.



Part of the wear and tear of shipping is the practice of dumping loads from nets.

The improvement of packaging materials and techniques afforded considerable relief on the packaging problem overseas but did not solve it. Repackaging operations overseas are of several types, the most important of which are: Repackaging of supplies from packages which have failed; repackaging bulk supplies into small packages for shipment to forward units; repackaging supplies opened for inspection or partial issue; packaging excess supplies for shipment to the United States or to another area; packaging repaired material for shipment or storage.

Improvement in the quality of the initial packaging and proper determination of the unit quantity per package will greatly reduce the amount of work demanded by the first three requirements listed above. However there is a limit beyond which improvement of packaging is uneconomical.

The requirement for packaging supplies for shipment out of the theater is dependent upon other factors than initial packaging and will always exist. This is not a major problem in the early days of an operation but becomes so upon completion of combat operations in the area.

Equipment Ruined

The lack of proper packaging in the overseas theater in many instances resulted in equipment being received in the United States in damaged condition. One large shipment of weapons carriers was received at the Carteret Subdepot of Raritan Arsenal with ninety per cent of the drive shafts bent due to lack of proper protection!

In warfare where bases must be continually moved, as in the island hopping of the Pacific, large quantities of supplies must be reshipped many times. Many of the supplies will require identification and repackaging prior to shipment. In the Pacific it was not uncommon for supplies to be moved from one base to another as many as five times without even being identified at each base prior to shipment to the next one. This condition resulted from the nature of the Pacific area and the shortage of personnel. If excess supplies are not to be shipped from the area they must be properly prepared for long-term storage.

The need for packaging equipment repaired in maintenance shops for return to depot stocks cannot be eliminated and must not be slighted. A failure to pack such equipment properly will nullify the work of the maintenance organization. Unfortunately this sometimes did happen, as in the case of an ordnance shop in England that had a fine record on overhauling vehicle engines. The completed engines were crated and shipped without adequate preservative.

Fifty Per Cent Damaged

When the first shipments of these engines reached the maintenance organizations in France it was found that over fifty per cent of the engines were useless due to the valves, pistons, and other moving parts being "frozen" with rust. About the same ratio of unserviceability was found among those still in storage at the base shop. This unfortunate condition could have been prevented by proper packaging. Equipment being shipped to base shops for repair must also be protected or it may not be worth repairing by the time it can be worked on.

The provision for proper repackaging operations in overseas theaters was delayed by a lack of appreciation of the problem by most officers concerned. We had never fought a war under the conditions existing in many areas and were not prepared for the effects encountered. As a result of this lack of appreciation of the problem there was a lack of proper supervision and inspection of packaging operations. The actual repackaging work was handicapped by a shortage of trained personnel, packaging material, and equipment with which to perform the work.

No provision had been made for training personnel as packaging technicians, nor had allowances been made for them in tables of organization and equipment. The few men available with this type of training all too often found themselves assigned to other work. The need for this specialized personnel is well recognized by persons who had to deal with the problem in the field. This fact is borne out by a recent survey of 132 war-experienced Ordnance officers in which 125 emphasized the need for such personnel while only 7 did not feel they were required.

The shortage of packaging materials was a major handicap in the development of proper packaging procedures in overseas theaters. The shortage of packaging materials was the result of a failure to plan for proper procurement and distribution of these supplies because of lack of appreciation of the problem.

This situation was further aggravated by a shortage of shipping space for the transportation of these supplies overseas. The situation became so critical in some areas that it was necessary to assign men to dismantle old crates to salvage not only the lumber but also the nails. If it had not been for local procurement of some of the required packaging materials the repackaging and reshipping of supplies would have been hopelessly bogged down.

The Army set up sawmills in the jungles to supply part of the needs for lumber, and large quantities of supplies were purchased in such areas as Australia. The coöperation received from the Australians on this problem

Unloading through surf onto a beach is a good reason for waterproofing packages.

Storage conditions such as these ruin supplies that are not properly packaged.

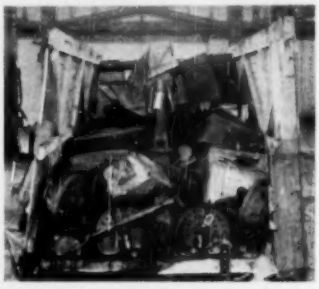
was excellent. A list of packaging materials obtained from them would be very long and would include such items as lumber, nails, hardware, tin and fiber containers, and special preservative oils developed in coördination with the Australian oil companies.

In some cases the materials were of excellent quality, such as the preservative oils, while other items, such as waterproof fiber containers, were never entirely satisfactory even though they had samples of ours to go by.

The Australian lumber was much harder and heavier than American lumber, and our soldiers found it very difficult to drive nails into it without bending them. This trouble was partially overcome when nails manufactured to Australian specifications were used. The extra weight of the lumber added greatly to the shipping weight of our supplies. For example, Ordnance repacked a large quantity of 105-mm. ammunition in 2-round crates; the total weight of each package was 130 pounds, of which 40 pounds was the weight of the crate.

The packaging effort was also handicapped by the lack of equipment for proper performance of the work, although this was the least important of the handicaps. The slow hand methods and improvisation of equipment overcame this difficulty to a great degree, but the operations would have been much more efficient if the depot and maintenance organizations had been equipped with the necessary hand tools, heating equipment, dip tanks, power saws, and similar facilities with which to perform their packaging mission.

The method of providing and using specialized packaging personnel is a point on which there has been considerable difference of opinion and one which the technical services of the Army have under study at the present time. This personnel may be provided either by including them in the tables of organization and equipment for depot and maintenance companies or by making them available as small teams to be assigned as required.



This mess is a 40-mm. gun as received at Aberdeen Proving Ground from overseas.

These supplies received in a forward area might as well never have been shipped.

Selection of Personnel

The personnel selected for the work should be of high caliber and well trained as they will be required to instruct, supervise, and inspect in connection with packaging operations and must also be capable of determining the reasons for package failures and developing corrective measures.

Near the end of the last war a limited number of packaging teams became available and did excellent work. The use of separate packaging teams allows the greatest flexibility, while including the individuals in depot and maintenance companies ensures their being available when needed.

It is probable that the best solution will be to include enough personnel in the companies for minimum requirements and then provide teams of approximately one officer and ten enlisted men for assignment as required.

An appreciation of the use of a packaging team where the load is abnormal may be obtained by considering the operation carried on at the Ordnance General Supply Depot at Manila in 1946. This depot was an agency of the Headquarters, Army Forces, Western Pacific, and had the mission of supplying Army ordnance material to all forces in the Manila area, receiving ordnance material from other island bases which were being closed, and declaring, segregating, and storing war surplus items.

Much of the material received from the other island bases had been moved from base to base through the New Guinea and Philippine campaigns, and its condition was extremely poor. The bulk of the material, regardless of its source, had been through one rainy season in open storage and the prospect was that it would spend another wet season in the open before it could be moved to covered storage.

Packaging Team

A packaging team consisting of one officer and nine men was set to work to correct the packaging deficiencies. The officer in charge of the team was assigned as assistant chief of storage with principal duty as supervisor of the repackaging activities. The operations were established in a prefabricated warehouse and included inspection, reconditioning, box-making, and repackaging sections set up on a production-line basis. The box shop also supplied the box requirements of all other sections of the depot.

The enlisted men of the team were used to conduct the operations of the sections. Four men were divided into two groups, with Filipino helpers, for the inspection of stocks in storage. These groups inspected the material and either declared the packaging satisfactory, made minor repairs on the spot, or had the material removed to the shop for processing.

Two men were placed in charge of the repackaging section which they operated with from fifty to one hundred Japanese prisoners. One man was put in charge of the box shop with thirty to fifty Filipino carpenters to operate it. The remaining two men were assigned to the shipping section of the depot where they supervised the packaging of shipments leaving the depot.

Future Goals

Because of the importance of this problem, from both a military and economic standpoint, it is important that the armed forces, working closely with industry, accomplish the following: (1) Provide adequate, properly trained personnel to perform the work; (2) Develop and ensure the availability of adequate supplies of the best possible packaging materials; and (3) Prepare instructions covering the best techniques of packaging for both arsenal and field conditions and keep them up to date.

Month by Month: A Review of the National Defense Situation

FIXED-PRICE CONTRACTS

Fixed-price contracts of the Army, Navy, and Air Force soon will contain identical clauses, thus simplifying procurement. The new standardized contract clauses will apply in all fixed-price contracts initiated on and after October 1, 1949, or executed on or after January 1, 1950. They will apply to fixed-price contracts entered into by either formal advertising or negotiation. Included in the clauses are stipulations as to inspection, convict labor, responsibility for supplies, nondiscrimination in employment, termination at convenience of the Government, changes, and a number of others. Some are to be used in all fixed-price supply contracts and others are for inclusion when applicable.

The new regulations were developed by an interdepartmental committee consisting of: Brig. Gen. E. M. Brannon and Col. P. M. Seleen, Army; Rear Adm. J. D. Boyle and Mr. H. B. Gross, Navy; and Brig. Gen. W. T. Thurman and Col. P. W. Smith, Air Force.

CIVILIAN COMPONENTS POLICY BOARD

Secretary of Defense Louis Johnson recently created a Civilian Components Policy Board to coördinate all policy and programs of civilian components of the armed forces. The board, which will be permanent, is authorized to study and evaluate all questions affecting the organized reserves of the Army, Navy (including Marines), Air Force, and the National Guard, both ground and air.

The board will consist of a civilian chairman, a military executive officer, and eighteen other members comprising two officers from each of the Reserve components of the Army, Navy, Marine Corps, and Air Force; two officers from the Army National Guard and two from the Air National Guard; and two Army, two Navy (one from the Marine Corps), and two Air Force officers from the Regular Establishments. The board will function on a full-time basis.

NEW PROPELLANT PLANT

Research and development of solid propellants for all types of weapons will be conducted at the new facility dedicated recently at the U. S. Naval Powder Factory, Indian Head, Md. The facility, named the Patterson Pilot Plant after the late eminent naval powder expert, Dr. George W. Patterson, consists of several units for the production of experimental lots of propellants for rockets, guns, and guided missiles. This plant permits the Navy to expand the work of the Naval Powder Factory in the field of propellants, previously limited primarily to research. It will now be possible to manufacture gun and other propellants on a small scale to provide lots sufficient for service tests and for evaluation.

The principal address at the dedication was delivered by Dr. R. E. Gibson, director of the Applied Physics Laboratory of the Johns Hopkins University, which has the technical direction of one of the guided-missile programs of the Navy's Bureau of Ordnance. Other speakers at the dedication ceremony included Rear Adm. A. G. Noble, Chief of the Bureau of Ordnance; Capt. C. E. Voegeli, commanding officer of the Naval Powder Factory; and Francis C. Thames, director of research and development at the factory.

AF OFFICER TRAINING

Air Force officers are being put through vigorous training programs in industrial mobilization. This year twenty-four Air Force officers are studying in American industrial plants. First phase of their training is attendance at civilian colleges and universities to study the fundamentals of modern business management. Phase B combines alternating education and procurement assignments. Phase C is assignment to a procurement or industrial-mobilization activity within the Air Force and represents on-the-job training wherein knowledge obtained in earlier phases is coördinated with operations' experience. Next step is the Industrial College of the Armed Forces. The whole training cycle lasts from five to seven years.

NEW ENGINE COMMITTEE

The new Munitions Board Industry Advisory Committee for Internal Combustion Engines will soon have from the Army Engineers, the Navy, and from Army Ordnance lists showing sizes and types of industrial, automotive, and marine engines which the armed services will require in the foreseeable future. That information, available on such a scale for the first time, will enable the Advisory Committee to examine the problem of standardization of engines and parts.

The committee took over from a prior committee composed of much the same personnel which had been studying industrial engines. The new committee, which will consider industrial, automotive, and marine engines, elected the same officers which served the earlier committee. The officers are: C. E. Nelson, Jr., vice-president, Waukesha Motor Company, chairman; H. W. Smith, Caterpillar Tractor Company, vice-chairman; and G. Waine Thomas, chief engineer, Continental Motors Corporation, secretary.

STOCK PILE REPORT

Completion of the national stock pile of strategic and critical materials will close one of the roads to war, the Munitions Board told Congress in its stock-piling report for the first six months of 1949. Cost of the completed stock pile is estimated at $3,217,000,000, a reduction from the January estimated cost of $3,700,000,000, owing to lowered costs of materials.

Forty per cent of the planned stock pile was on hand or under contract on June 30, 1949. It is expected that commitments to be made during the current fiscal year will bring the stock pile to over sixty per cent, on hand or under contract, of the total objective by June 30, 1950.

Any alteration in the basic principles of stock-piling would have a serious adverse effect on the stock pile's value to the national security, the Board declared. Procurement has been scheduled to provide the maximum of national security for every dollar spent, and any shifting of schedules would mean less security for the money.

All materials being stock-piled are essential, the report said, and cited manganese as an example. The steel industry depends absolutely on manganese, but even if the industry were assured of all the manganese it could consume, there still would be the problem of stock-piling enough chromium, nickel, vanadium, and tungsten to form the

necessary alloys of steel and to make the tools with which to work them. A plentiful supply of one item might be useless for want of another.

Increasing quantities of materials are beginning to flow into the stock pile from European nations and their possessions through the Economic Coöperation Administration, the report declared. By June 30, 1949, the ECA had placed contracts for $36,247,860 worth of commodities, including rubber, sisal, diamonds, quinidine, graphite, kyanite, cobalt, palm oil, platinum, sperm oil, tantalite, and other items from the United Kingdom, France, and Netherlands East Indies. Two Scandinavian contracts have been completed for materials valued at an additional $536,500. Negotiations now pending by ECA involve further quantities of materials valued at $34,788,500.

A section of the report is given over to work of the other governmental departments under the stock-piling act. The Department of Interior has intensified operations looking toward improving the country's domestic position with respect to strategic and critical materials. Some of the materials studied include titanium, zirconium, and some abrasives. Titanium has been developed to the commercial threshold stage. Ductile zirconium has been developed to the large-scale pilot-plant stage. Both titanium and zirconium possess physical and chemical properties that make them admirably suitable for many industrial uses: titanium for strong and light forgings, sheets and other structural uses; zirconium in heat-resisting and corrosion-resisting uses. In these uses, the Interior Department stated, they may partially replace certain strategic metals. The Interior Department also is developing such very hard materials as metal carbides and borides as substitutes for industrial diamonds in some uses.

The Department of Agriculture, under the Stock Piling Act, has initiated projects for the production and processing of guayule, kok-saghyz, and other related plants which offer possibilities for domestic production of rubber in an emergency. Enough guayule seed to plant about 100,000 acres is maintained as an emergency stock pile in connection with this project.

In addition to actions taken under the Stock Piling Act, a corps of about fifty technicians of the Agriculture Department are conducting research and extension work in association with personnel of fourteen other American republics leading to expanded production of castor oil, abaca, sisal, emetine, palm oil, pyrethrum, quinidine, quinine, rubber (hevea), jute substitute (kenaf), and henequin, under Public Law 402 (Eightieth Congress).

UNIT HISTORIES

The New York City Public Library has the largest collection of material on the World War II activities of U. S. armed forces units to be found anywhere in the country. The library has acquired nearly a thousand unit histories, and much of this collection is due to the zeal and "detective work" of C. E. Dornbusch, special assistant in the library's acquisitions division, formerly with the 409th Infantry Regiment. Because some of the material was privately printed, because just enough copies for each unit were issued, and because many of the men did not save their copies, it has been a monumental task for Mr. Dornbusch to round up this elusive material.

The project was begun late in 1947. Mr. Dornbusch's "sleuthing" was carried on by correspondence which covered the forty-eight States and many countries of Europe and Asia. He worked with War Department officials in tracking down rosters. He not only advertised in veterans' publications of all kinds, but read them all, looking for a clue that might lead to a missing history. "We even welcomed the indignant letters," Mr. Dornbusch said, "from ex-GI's who read about the project and protested the omission of their units. Some of them sent copies voluntarily, others lent them cautiously for photostating. Some volumes had to be bought. One set of histories was finally located in the hands of a German printer who had the only remaining stock. He demanded—and got—payment in CARE packages, one for each book."

Some of the outstanding books in the collection are "Thunderbolt across Europe," edited by men of the 5th Infantry and printed in Germany; "The 305th Division Artillery," printed in Japan; and "The 71st Infantry Division"—another unit history printed in Germany.

Ordnancemen who know of any Ordnance unit histories are asked to send the title and any pertinent facts of content and publication to Mr. Dornbusch.

THE EXPERTS SAY—

Louis Johnson, Secretary of Defense: "While the atom bomb has greatly multiplied the destructive force of air power, its effect upon war strategy and the length of war has not yet been completely explored. Certainly the atom bomb is not the absolute weapon. But neither is it just another piece of ordnance which has modified only slightly the strategy of war. The great significance of the atom bomb lies in the destructive and denial power that may be carried in a single aircraft."

W. Stuart Symington, Secretary of the Air Force: "Time—that is, time to mobilize our resources for war—has been shortened to a tiny fraction of what it formerly was. The incredibly rapid development of weapons is responsible for this. As example, the existence of the intercontinental bomber carrying the atomic bomb, or other weapons of mass destruction, has created a military task without parallel. . ."

Dan A. Kimball, Under Secretary of the Navy: "The next twenty years should bring forth great advances in undersea warfare. Increases in speed and range may be expected for the submarine of the future. The employment of guided missiles will have a pronounced effect on its size. In the field of underwater sound we have only scratched the surface—or should I say subsurface? Developments such as these will make the submarine of the future even more complex than it already is; the same will be true of its weapons."

Gen. J. Lawton Collins, new Chief of Staff, United States Army: "The Ordnance Department and other agencies of the War Department [during World War II] sent right out to the front teams with these new weapons to teach us how these new weapons worked, to test them right out in the field, to see what was the matter with them, and to report back promptly to industry or to the arsenals to make the necessary corrections. We got wonderful coördination between this team of science, industry, and the armed forces. The results were the saving of lives and ultimate victory. Actually our casualties during the past war were twenty per cent of our enemies', despite the fact that usually we were fighting against greater odds so far as numbers were concerned."

"Peace through Strength"

PEACE is the basic objective of the North Atlantic Treaty—as ratified by the United States Senate on July 21, 1949, by an overwhelming vote of eighty-two to thirteen.

The Treaty seeks to avert war by demonstrating strength of purpose and unity of action among twelve peace-minded nations, including the United States of America.

The ratification of the Treaty marks an epochal departure from our traditional foreign policy.

Isolationism, or "minding our own business," has now lost all validity as a national policy.

Neutrality which fails to distinguish between the aggressor and the victim, between the killer and the corpse, now appears in its true light not only as selfish—but as immoral.

Paper pacts and expressions of a pious wish for peace will not in themselves avert war.

History teaches us that without physical strength to back up moral strength all the good intentions in the world are valueless—and may even be dangerous.

Two World Wars have driven home to us the hard, inescapable lesson that the time to stop a war is before it starts—and the way to stop it is to be strong on the ground, at sea, and in the air.

We have also learned that the stronger we are ashore, afloat, and aloft, the less is the probability that we shall ever have to exert our military, naval, and air strength.

Today, however, even a strong America is not a safe America.

We need friends among the peace-seeking nations, and those friends must also be strong if they are to be of effective assistance in keeping the peace of the world and contributing to our own national security.

It is worthy of note that the free nations of the world, in their anxiety to place themselves in condition to resist aggression, request *arms* as the crucial item in their struggle for survival.

As always, ordnance is the essential ingredient in any prescription for military, naval, or air strength.

On the Fourth of July—the 173rd anniversary of our own Declaration of Independence—the Honorable Louis Johnson, Secretary of Defense, United States of America, called for "Peace through Strength" and pointed out that "had America been adequately prepared we might never have had a World War II."

For the *armed* forces of the free nations of the world only *ordnance* can assure "Peace through Strength."

James L Walsh

President, American Ordnance Association

Association Affairs

• **THE AMERICAN ORDNANCE ASSOCIATION'S SCHOLARSHIP AWARDS** have recently been presented to outstanding R.O.T.C. Ordnance students in various colleges and universities throughout the country. These medals have been given in recognition of their superior records as student officers and promising ordnancemen. They will be able to assume their proper positions in the Ordnance fraternity to help in creating a strong America for a lasting peace.

At the University of Michigan **Cadet Col. Louis H. T. Dehmlow** received the Association's award for his "particularly outstanding record. During his last year with Ordnance R.O.T.C. Mr. Dehmlow has been president of the local Post of the A.O.A., cadet colonel of the University of Michigan Corps of Cadets, captain of Scabbard and Blade, captain of Pershing Rifles, elected to Vulcans (honorary senior engineering society) as well as maintaining a good academic scholastic record." Mr. Dehmlow represents through his achievements the highest standards as a student and an American.

Cadet Capt. Raymond S. Bergman of the University of Cincinnati, received the A.O.A. award as the outstanding Ordnance student of the University's R.O.T.C. A veteran with overseas service, Mr. Bergman believes that R.O.T.C. training is one of the essential elements of national security. "For example," he says, "the Ordnance R.O.T.C. program has given us, as future Ordnance officers, a sound and extensive background for solving distribution, maintenance, and related problems arising out of wartime conditions. This program has taught us to accept responsibilities and has developed those techniques of leadership which will better qualify us for a successful military or professional career." Achieving a military and scholastic average of 91 per cent, Mr. Bergman more than qualified for the Association's medal.

Another Ordnanceman of great promise is **Cadet Lieut. Col. Peter L. Akers** of Virginia Polytechnic Institute. Achieving a distinguished scholastic and military record, he is convinced that "Ordnance R.O.T.C. has been of great aid to my studies . . . it has widened my knowledge of technical subjects and stimulated my interest in all phases of industry. I have gained an acute awareness of the teamwork necessary between the military . . . and industry."

L. H. T. Dehmlow

R. S. Bergman

P. L. Akers

W. M. Goodman

S. L. Albertalli

R. G. Carter

R. L. Walton

W. J. Stoffregen

D. A. Shmidt

D. F. Beecher

At Clemson College, **Cadet Capt. W. M. Goodman** received the A.O.A. award as No. 1 man in the Ordnance R.O.T.C. unit. Mr. Goodman represents the type of future officer who will contribute much to the high standards maintained by the Ordnance Department.

Cadet 2nd Lieut. Stephen L. Albertalli of Rutgers University was top man of his Ordnance unit, maintaining a superior record both militarily and scholastically. A ceramics engineering major, he believes that not only has Ordnance R.O.T.C. fulfilled all his expectations but has particularly broadened his education and outlook.

At Ohio State University, the A.O.A.'s award was presented to **Cadet 2nd Lieut. Robert G. Carter** whose record, scholastically and militarily, has been outstanding. He was the honor Ordnance R.O.T.C. cadet of the university. This recognition of Lieutenant Carter's achievement is well deserved when it is recognized that Ordnance training demands the highest standards of scholastic effort and character.

As an outstanding Ordnance student, the A.O.A. award was presented to **Cadet 2nd Lieut. Richard L. Walton** of the University of Oklahoma. An honor student and an athlete both in secondary school and college, Mr. Walton's scholastic career has been marked by his widespread activity and participation in various fields. He is a member of Sigma Tau and Pi Tau Sigma, honor engineering societies.

Cadet William J. Stoffregen of the Agricultural and Mechanical College of Texas, having achieved a splendid record as a military and academic student, was presented with the Association's award as an outstanding Ordnance R.O.T.C. cadet. Prominent in extracurricular activities at his college, Mr. Stoffregen is working for two degrees at the same time, one in business administration and another in agricultural engineering. In the R.O.T.C. he sees not only a great contribution to his personal development but also a distinct aid to his career in civilian life.

As an infantry combat veteran of the European theater and later as an Ordnance soldier **Cadet Maj. Donald A. Shmidt** of Michigan State College has established a distinguished career in the R.O.T.C. He was awarded the Association's medal for his outstanding record in ordnance activity and believes that his experience, both as a veteran and a

student Ordnance officer, has helped him to understand more fully the requisites for world peace and the need for superior equipment in the armed forces.

Another Ordnance student who has been honored for his superior performance is **Cadet Maj. Donald F. Beecher**, the recipient of the Association's award to the outstanding Ordnance R.O.T.C. cadet at Cornell University. He believes that his studies in ordnance have given him many advantages. He feels that the R.O.T.C. develop poise and leadership and in addition, that his experience during training gave him an insight into many things that will effect the future security of America.

Cadet Thomas C. Jenkins of the University of Illinois was nominated as the outstanding R.O.T.C. Ordnance student of his class and received the Association's award. He fully met the high standards required of a cadet and an ordnanceman, both in military and scholastic activity.

At the Georgia Institute of Technology, **Cadet Carl H. Hudson** received the A.O.A. medal for his superior standing as an ordnance student. His record was in complete accord with the high level of performance required for recognition as a cadet of high achievement.

As the leading Ordnance R.O.T.C. student of the University of Nebraska, **Cadet 2nd Lieut. John B. Wescott** received the Association's medal for outstanding performance. He is majoring in mechanical engineering and has achieved an enviable career both scholastically and militarily.

Cadet Capt. Errol E. Hayes, Jr., of the University of North Carolina, is another leading honor student in Ordnance R.O.T.C. to receive the A.O.A. medal and was also nominated as an outstanding cadet and military graduate for a possible Regular Army commission.

Cadet Milton F. Lindgren of the University of Minnesota, through his extraordinary efforts has established a leading position as an honor Ordnance R.O.T.C. student. His excellent scholastic and military record has marked him as a leading cadet of his class.

Leading his Ordnance group at Purdue University, **Cadet Robert L. Bryant** of the February graduating class received the Association's medal for his diligence and excellent record. He exemplifies the highest standards desired for future officers and ordnancemen of the Army. **Cadet Howard A. Aronson**, also of Purdue University received his award at the June graduation exercises. His standing as a cadet officer and student was exemplary, maintaining standards of excellence both scholastically and militarily.

• **THE LONE STAR POST OF THE A.O.A.** held a special summer meeting in the offices of the Murray Company of Texas, Inc., during July at which the following members were present: Sam Hamer, Warren Wells, William Harrison, M. J. Neely—all of Fort Worth; Graham Brown of Wichita Falls; and the following Dallas members: Melvin Jackson, H. L. Haslbauer, Donald Mitchell, Mr. Hollingsworth, Dewey D. Day, Stanley Patterson, Robert Campbell, J. Kirby McDonough, C. W. Hodde, and J. W. Behle.

The following Post officials were elected: Mr. Behle, president; Mr. Mitchell, vice-president; W. O. Beeman, secretary-treasurer; E. H. Brooks, G. H. Brown, S. P. Hamer, A. A. Hardy, F. L. Lebus, G. G. McDonald, Charles Medley, F. A. Pierce, and H. S. Zane, Jr., directors.

It is planned to hold a general meeting of the Post membership in October at which a prominent speaker will address the gathering.

• **THE ORDNANCE R.O.T.C. ENCAMPMENT** at Aberdeen Proving Ground this summer was highlighted by the presentation of American Ordnance Association plaques and medals for athletic prowess. The awards were presented by James L. Walsh, president of the Association, at final ceremonies at Aberdeen on July 28th. Maj. Gen. Everett S. Hughes, Chief of Ordnance of the Army, addressed the cadets and took the final review. Following is a list of the awards and recipients.

PLACQUES: Outstanding School Award, Rutgers University (Received by Cadet R. R. Howard); School Marksmanship Award, A. & M. College of Texas (Received by Cadet H. J. Derr); Softball Champion Team, Rutgers University (Received by Cadet R. A. Gerweck); Volleyball Champion Team, Massachusetts Institute of Technology (Received by Cadet O. F. Noss).

SILVER MEDALS: Outstanding Cadet Award, Cadet R. D. Boysel of Purdue University; Outstanding Athlete Award, Cadet R. S. Hayes of University of Oklahoma; Highest Marksmanship Award, Cadet G. S. Kent of A. & M. College of Texas.

BRONZE MEDALS: Second Highest Marksmanship Score, Cadet W. E. Woodhead of The Citadel; 100-yard Dash, Cadet J. W. Lyon of Louisiana State University; 220-yard Dash, Cadet G. M. Everitt of Georgia Institute of Technology; 440-yard Run, Cadet H. R. Burns of University of Oklahoma; 880-yard Run, Cadet W. W. Hock of Brooklyn Polytechnic Institute; 880-yard Relay team members, Cadets D. E. Johnson, R. M. Fatto, N. A. Gelfman, and R. E. Barlow, all of Rutgers University.

High Jump, Cadet W. T. Swofford of University of Illinois; Broad Jump, Cadet J. R. Wetch of University of California; Discus Throw and Shot Put, Cadet T. L. Brown of Missouri School of Mines.

The 50-yard Freestyle, Cadet C. D. Caldwell of Purdue University; 50-yard Backstroke, Cadet R. C. Beckman of Michigan State; 50-yard Breaststroke, Cadet P. J. Howard of City College of New York; 100-yard Freestyle, and Low-Board Diving, Cadet R. S. Hayes of University of Oklahoma; High-Board Diving, Cadet J. R. Harris of Rutgers University.

Tennis Champion (singles), Cadet G. Hill of University of Oklahoma; Tennis Champion (doubles), Cadet A. J. Hankinson of University of Oklahoma; Tennis Champion (doubles), Cadet G. Hill of University of Oklahoma; Golf Champion, Cadet A. P. Oot of Cornell University.

• **THE QUAD CITIES-IOWA POST** held an interesting session at Rock Island Arsenal, Rock Island, Ill., on June 23rd. While most of the members toured the shop facilities of the Arsenal, some took advantage of the excellent links at the arsenal's golf club.

After lunch in the arsenal cafeteria, a conducted tour was made through the new sheet and plate mill of the Aluminum Company of America at near-by Bettendorf, Iowa.

Dinner was held at the Rock Island Post restaurant at which the newly elected officers of the Quad Cities-Iowa Post were installed by Retiring President T. E. Stahl. The new president, G. A. Uhlmeyer, then took the chair and conducted a brief business session.

Principal address at the meeting was by Brig. Gen. Philip G. Blackmore, commanding officer of White Sands Proving Ground, N. Mex., who spoke on the part that White Sands is playing in the testing and development of high-speed, high-altitude rockets.

In addition to Mr. Uhlmeyer, the new Post officials are: Karl E. Madden, vice-president; Donald L. Meyers, secretary-treasurer; and the following directors: Col. C. D. Wiman, T. E. Stahl, G. L. Weissenburger, L. M. Gildea, Col. C. A. Waldmann, E. W. Ross, L. A. Murphy, N. L. Etten, Clay Murray, William Voss, Samuel G. Rose, and Maj. John Ploehn.

• **THE MICHIGAN POST** staged a very successful summer meeting at the Grosse Isle Naval Station in late June. The affair was a combination father-and-son day, A.O.A. meeting, and aircraft demonstration. Despite a rainy forenoon it was a huge success—1,400 Association members and guests attending—and the numbers of "junior" Ordnanceites far exceeded expectations. The demonstrations were also open to the public and about 25,000 persons witnessed the events.

The A.O.A. program in the morning was devoted to sports and examination of the facilities of the naval station and the splendid static and mobile displays.

Under clearing skies, the air demonstration got under way promptly at 2 p.m. when four members of the official Marine Flight Exhibition Team put on a terrific show of high-speed coördination and tactics with their McDonald FH-1 Phantoms. This group was followed by the "Blue Angels"—a Navy 4-man precision flight team flying prop-driven Grumann F8F Bearcats. This team did just about everything possible with a propeller-driven ship, and their close formations and coördination were inspiring.

This exhibition was followed by a thrilling mass "attack" on the flying field by Carrier Group 59 composed of Grosse Isle Naval Reserves who spend their weekends in flight training. Their splendid performance made it difficult to believe that these men were not in daily training for their exacting task. This group also demonstrated the procedure of landing on a carrier deck.

One of the most spectacular events of the day was the jet-assisted take-off of the "Truculent Turtle," the famed Navy patrol bomber. The big ship started slowly down the runway, but was boosted into the air in an incredibly short run after the "jato" was fired. This Lockheed P2V shattered all previous records in October 1946 when it flew from Perth, Australia, to Columbus, Ohio, nonstop—a distance of 11,200 miles—in 54 hours without refueling.

The air demonstration ended with an aërial review of the various types of aircraft participating in the day's exhibition.

• **FRANK J. SMITH, PRESIDENT OF THE EMPIRE POST,** American Ordnance Association, died June 12, 1949, at the age of 63. One of the founders of the Post in 1938, he had served as its president throughout the second World War and until his death.

A leader of Rochester industry, he had taken a leading part in the mobilization for ordnance production even before Pearl Harbor, and as an executive of the Rochester Ordnance District he was of immeasurable assistance in the war effort.

He worked closely with the executive officers and district chiefs including Cols. Roy Bowlin, Frank Atwood, Merle Davis, Charles F. Mosher, H. L. Campbell, and the present chief, Lyman K. Stuart.

President of John P. Smith Company, one of the larger printing establishments in up-state New York since 1922, Frank had served as president of United Typothetae of America—one of the first and largest trade associations in the world—and also as president of the Printers National Association. But these were only two of his industrial and civic activities.

As special assistant of Colonel Bowlin in the Rochester Ordnance District in 1941, Mr. Smith rendered outstanding service by reason of his great energy, ability, and familiarity with the industrial potential of the district.

Following the war he and Col. Merle Davis organized a number of chapters of the Empire Post, A.O.A., extending across New York State from Albany to Buffalo. The active programs of many of these chapters are a tribute to the ability and enthusiasm of the Smith-Davis team.

In the passing of this loyal friend of Ordnance, the fraternity has lost the companionship of a tireless proponent of industrial preparedness. His ready smile, instant coöperation, and firm attachment to the principles in which he believed were the basis of a life of true service to God, country, and his fellow men.—L.A.C.

• **J. D. BERG,** chief executive officer and a director of the Dravo Corporation, Pittsburgh, died June 29, 1949, in his home in Chatham, Cape Cod, Mass., at the age of 66. For many years he had been a leader in Ordnance affairs in Pittsburgh in close coöperation with his lifelong friend the late Frank Bell.

Mr. Berg headed the Dravo Corporation since the death of its founders, F. R. and R. M. Dravo, in 1934. He served as board chairman from 1934 to 1946, at which time he was elected to his present position. Although Mr. Berg resided for the past two years in Chatham, he remained active in the affairs of the Dravo Corporation.

Mr. Berg became identified with Dravo-Doyle Company, now a subsidiary of the Dravo Corporation, in 1906 as sales engineer, becoming vice-president in 1908 and president in 1923. He was prominent in civic affairs as well as being an outstanding Pittsburgh industrialist. He was a director of Dravo-Doyle Company, Fullerton-Portsmouth Bridge Company, and Consolidated Natural Gas Company.

Mr. Berg graduated from Lehigh University in 1905 and has served as a trustee of that institution for a number of years. His degrees include that of M.E. in 1905 and Doctor of Engineering (honorary) in 1947. Earlier he attended public school and the Central High School, Pittsburgh.

From 1938 until 1941, he was assistant chief, Pittsburgh Ordnance District, and later served as chief from September 1941 to January 1942. Subsequently he was a member of the advisory board, Pittsburgh Ordnance District, from 1942 to 1946.

Dan Berg will be missed by his countless friends throughout the Ordnance fraternity. Kindly but firm, soft-spoken but emphatic, he combined the finest characteristics of American industrial leadership. His contributions to the national defense of his country in peace and in war are beyond estimate.—L.A.C.

• **THE EMPIRE POST LOST ANOTHER OF ITS STALWARTS** when Chauncey W. Cook, chairman of the Capital Cities Chapter, died at Troy, N. Y., August 4, 1949. He was president of the Manufacturers National Bank and prominent in the business and civic life of Troy.

Although active in many enterprises, his interest in Ordnance was very keen and he had planned a number of activities for the chapter during the coming year.

During World War I Mr. Cook, prior to the entry of the United States, was general superintendent of Dominion Foundries and Steel, Ltd., Hamilton, Ontario. Later he was commissioned in the United States Army and served in France. In the second World War he took a leading part in the mobilization of industry in northeastern New York.

His loss will be keenly felt throughout the Ordnance fraternity. The goals he sought for the national defense of our country will be sought with renewed determination by his associates because of his example of diligence and active patriotism.

• **NOTICE ALSO HAS BEEN RECEIVED OF THE DEATHS** of the following members of the Association: J. G. Arlinghaus, Lakewood, Ohio; D. R. Ballentine, Detroit, Mich.; Frank Brotz, Kohler, Wis.; J. W. Bryce, New York, N. Y.; C. D. Cheney, Manchester, Conn.; A. W. Eames, San Francisco, Calif.; M. K. Easley, Columbus, Ohio; E. F. Entwisle, Buffalo, N. Y.; W. E. Garwood, Springfield, Mass.; D. M. Gillespie, Denver, Colo.; J. C. Godfrey, Yonkers, N. Y.; W. B. Gwinn, Crystal City, Mo.; G. H. Harries, Bally, Pa.; T. L. Holland, Detroit, Mich.; S. C. Hurley, Danville, Ill.; A. R. Kenny, Lansing, Mich.; F. Kirkhoff, Cincinnati, Ohio; H. F. Knight, Boston, Mass.; L. B. Martin, Brooklyn, N. Y.; E. G. Meckstroth, Cincinnati, Ohio; P. S. Millar, New York, N. Y.; L. B. Miller, Cincinnati, Ohio; O. S. More, Denver, Colo.; L. R. Page, Philadelphia, Pa.; R. P. Page, Ardmore, Pa.; H. E. Schank, Detroit, Mich.; H. E. Schofield, Philadelphia, Pa.; Herman Seltmann, New York, N. Y.; C. D. Stotts, Lima, Ohio; J. R. Thompson, New Castle, Ind.; C. P. Weekes, Massillon, Ohio; Adolph Wintner, Evansville, Ind.; Lafayette Young, Alton, Ill. To their relatives and friends, ORDNANCE, on behalf of the Association membership, extends condolences.

Communications

STOCK-PILING IMPORTANT MATERIALS

THE EDITOR.—In discussing the stock-piling of strategic and critical materials, the author of the AMERICAN ORDNANCE LETTER recently stated that in his opinion: ". . . . the physical stock pile . . . from the standpoint of national defense . . . is in such shape that we could now meet successfully any emergency that might be thrust upon the United States." Since almost no data were supplied upon which to base this rather startling opinion, we must examine carefully such information that has been released, consistent with security considerations, concerning the actual status of the stock pile.

It was recently revealed[1] that the total assumed war requirements of those strategic and critical materials on the stock-pile list would cost about $12,409,000,000. In an emergency these materials are expected to be obtained from the following sources:

Domestic production	$4,464,000,000=36%
Imports	4,179,000,000=34%
The stock pile (when complete)	3,766,000,000=30%

It was further revealed that as of the end of the calendar year 1948 only about 7 per cent of our total assumed war requirements were actually *on hand* (discounting material in the ground), since only materials worth $821,000,000 were in the Government stock pile, having been obtained as follows: From pre-World War II stock piles and from World War II surplus stocks, $650,000,000 (5-plus per cent); from post-World War II purchases, $171,000,000 (one-plus per cent).

At the hearings concerning stock-pile appropriations, when questioned as to the present position of stock-piling as compared with the beginning of World War II, a top representative of the Munitions Board stated: ". . . we are better off although, of course, today industry has less in its inventories than it had at the beginning of World War II. On the whole . . . we would be slightly better off today." Therefore, we must next consider our stock-pile position at the beginning of World War II.

The accompanying table covers important metals and minerals that were included in the pre-World War II stock-pile program. A quick consideration of this table will reveal two major points:

a. In almost every case materials on hand in the stock pile at the start of the war represented but a small fraction of the stock-pile goals.

b. Those stock-pile goals were intended to provide for our deficiencies in a 3-year war. However, the WPB was forced to allocate materials to essential production and to issue hundreds of conservation and limitation orders while, in the year of our greatest shipping losses, we were forced to import more materials than in almost every case had been planned to be in the 3-year stock pile.

Thus it can be seen that our pre-World War II stock-pile program was a good example of both "too little and too late." Apparently our present position is not as yet substantially better.

As recently as January 26, 1949, the Secretary of the Interior, who, under Public Law 520, Seventy-ninth Congress, is vitally interested in the stock-pile program, stated:[2] "My opinion is that [the present] stock-pile goal is too low, and, sooner or later,

[1] "Hearings on the Treasury Department Appropriation Bill for 1950," United States Government Printing Office, 1949.

[2] "Hearings on the Interior Department Appropriation Bill for 1950," United States Government Printing Office, 1949.

		OFFICE OF PRODUCTION MANAGEMENT (For a 3-year Emergency)		NEW SUPPLY OBTAINED IN 1942		
Material	*Unit*	*Stock-pile Goals as of June 1941*	*On Hand as of Jan. 1, 1942*	*From Domestic Production*	*From Secondary Recovery*	*From Imports*
Aluminum	Short tons	—	—	521,000 (*a*)	196,000	112,000
Antimony	Short tons	27,000	7,822	6,211 (*b*)	18,200	21,595
Asbestos	Short tons	31,500	—	15,000	—	419,000
Beryllium	Short tons of ore	(*c*)	—	269	—	2,050
Cadmium	Short tons	6,000	57	3,686	158	27
Chromite	Short tons	1,950,000	320,000	113,000	—	982,000
Cobalt	Short tons	—	—	368	—	2,215
Copper	Short tons	500,000	69,187	1,080,000	928,000	751,000 (*d*)
Corundum	Short tons	—	—	—	—	4,739
Diamonds (industrial)	Carats	10,000,000	815,752	—	—	11,203,704
Graphite	Short tons	34,000	4,400	7,120	—	43,921
Iridium	Troy ounces	7,750	—	3,400	1,600	2,600
Kyanite	Short tons	—	—	8,708	—	6,524
Lead	Short tons	100,000	17,934	496,239	323,001	523,679
Manganese ore	Short tons	3,696,000	572,000	2,253,000 (*e*)	—	1,583,000 (*f*)
Mercury	Flasks of 76 lbs.	35,000	6,331	50,846	—	38,941 (*g*)
Mica (sheet)	Short tons	13,850	2,749	1,381 (*h*)	—	1,623 (*h*)
Nickel	Short tons	(*c*)	—	500	4,000	133,000
Quartz crystal	Pounds	1,002,000	1,804,786	—	—	2,612,106
Tin	Long tons	242,000	50,039	—	33,900	55,686 (*i*)
Tungsten	Short tons of ore	28,560	7,246	4,441 (*j*)	—	7,163 (*j*)
Vanadium	Short tons	—	—	2,220	—	1,288
Zinc	Short tons	150,000 (*k*)	88,697 (*k*)	768,025	330,526	323,628 (*l*)
Zircon	Short tons	—	—	several hundred	—	26,624 (*m*)

(*a*) 27% of the bauxite was imported.
(*b*) some from foreign ore.
(*c*) general authority to purchase in Brazil.
(*d*) 47% was imported as ore.
(*e*) 67% of domestic ore contained only 5% to 10% manganese.
(*f*) the imported ore averaged 48% manganese.
(*g*) large quantities were reexported.
(*h*) uncut sheet and punch.
(*i*) 52% was imported as ore.
(*j*) actual metal content of ore and concentrates.
(*k*) concentrates, not metal.
(*l*) 88% was imported as ore.
(*m*) 57% was Baddeleyite.

Sources: "Import Policies and Programs of the War Production Board and Predecessor Agencies"; Washington: Civilian Production Administration, May 1, 1947. "Minerals Yearbooks 1942–1945"; Washington: U. S. Bureau of Mines.

Important metals and minerals in the pre-World War II Government stock-pile program.

I expect it will be moved up a bit." This opinion is in decided contrast to that quoted in the first paragraph.

As a member of the A.O.A., I believe that the Association should do everything in its power to keep the uninformed from having an unwarranted feeling of security. Stock-piling of strategic and critical materials is an important part of our national-security program and requires informed public understanding. In these days of international tensions and uncertainties we must accumulate expeditiously those essential materials that could readily be denied to us in another emergency.[1] By every means available to it the A.O.A. should assist the accelerated accomplishment of the stock-pile program.

[1] See page 260, ORDNANCE, January-February, 1949.

DR. JOHN D. MORGAN, JR.

(Dr. Morgan is with the National Security Resources Board, Washington, D. C. The opinions expressed are those of the author and do not necessarily reflect official views.—EDITOR.)

READERS APPROVE A.O. LETTER

THE EDITOR.—The arrival of AMERICAN ORDNANCE LETTER No. 31, the first of the series by George S. Brady, has so impressed me and some of my friends that we feel that we should try to get it before more readers in our part of the country.

Mr. Brady could not have made his position more unmistakably clear if he had written a volume. More power and a wider audience to him!

RICHARD H. EURICH

Melville, Mont.

THE EDITOR.—I just received the AMERICAN ORDNANCE LETTER No. 31, and I think it is a wonderful exposition on the problems and conditions of the present day. It is too bad that every American could not read this letter.

W. C. CHENEY
Vice-President, Gillett & Eaton, Inc.

Lake City, Minn.

STILL MORE ON STRATEGIC BOMBING

THE EDITOR.—In the May-June issue of ORDNANCE Maj. John J. Driscoll has an article which attempts to refute the arguments against bombing cities set forth in General Fuller's book, on World War II and endorsed by me in my article, "The Folly of Strategic Bombing," which reviewed the treatment of air power in that book. Stripped of amiable irrelevancies such as the statement that Major Driscoll and I once served in the same infantry regiment and of astonishing errors such as the statement that either Fuller or I believe in the "impotency" of the air weapon, my opponent seems not to have noticed that he has quoted with approval a sentence from the Strategic Bombing Survey which covers most of Fuller's and my case.

The Survey says: "Hindsight inevitably suggests that it [*i.e.*, Anglo-American air power] might have been employed differently or better in some respects." However we interpret that quotation, as it stands its language covers the greater part of General Fuller's argument; namely, that World War II would have been won more quickly and with less loss—also that the subsequent peace would have been more worth winning—if in general the Anglo-American air effort had been put into fighters and fighter-bombers instead of being centered on long-range bombers. The talented Englishman adds that a higher priority—which always means the sacrifice of something else, in his opinion long-range bombers—should have been given to landing craft.

These are the questions at issue, and I respectfully submit that my opponent has only skirted around the edges of them.

HOFFMAN NICKERSON

Oyster Bay, L. I.

The Reserves

THE INACTIVE RESERVE

A growing belief that there is a stigma attached to membership in the Inactive Reserve is beginning to crop up among some members of this group. Feeling seems to be that the Army has relegated to limbo Inactives who don't take part in Reserve training. The situation was pointed up by ordered shift to Inactives on February 1st of Reservists who had not stated they would take part in the active program.

The facts are that Army planners fully realize the extreme importance of the Inactive Reserve as a pool of qualified officers able to supply techniques of American industry in support of field armies in war. The Army knows many Reserves want active training but can't get it because their homes are too far from training sites. Also the demands of business often will not allow participation in training. Evidence of the Army's interest in Inactives as an integral part of the "planned potential" of the United States is shown by the policy of having on tap at all times the qualification records of *all* Reserves for possible emergency use.

Current Army thinking is concerned with the necessity for making every member of each component of the Army—from generals to recruits—feel that his outfit is an important part of "the team." The Army's idea of the Inactive Reserve is a large, able, available reservoir of officers who have stated their willingness to serve their country in an emergency.

RESEARCH AND DEVELOPMENT

Qualified scientists, engineers, and medical research specialists are being organized into groups for Reserve training in Army research and development activities. Fifty-three Research and Development Officers' Reserve Corps groups are already formed. Qualified Reservists get special training and assignment; their services are used in the development of new weapons and equipment, and their technical abilities help to devise the tactics and strategy of modern warfare. Participants get inactive-duty training and retirement credit. Purpose of program: Efficient use of technical personnel in peace and proper assignment in war.

INACTIVE DUTY TRAINING PAY

An alphabetical list by States or other territorial divisions of finance offices designated to make payments to ORC members for inactive-duty training pay is given in SR 140-35-5, May 4, 1949, which also shows the method for receiving pay for inactive-duty training outside the United States.

CORRECT ADDRESS NEEDED

Instructions contained in each letter of appointment in the Officers' Reserve Corps and reiterated in paragraph *20b*, Special Regulations No. 140-5-1, make it the responsibility of every Reserve officer to report to proper authority whenever he makes any of the following changes: *a*. Obtains a new permanent home address or temporary address; *b*. Intends to travel to or establish residence in a foreign country; *c*. Becomes an officer or warrant officer or is enlisted in any of the armed services of the United States in an active status; *d*. Assumes or vacates any public or civil office or position under the Federal Government.

An increasingly large number of officers are failing to render reports of change in permanent home address. Such action on their part is hazardous to their own interests.

Atomic Energy

300,000,000-VOLT ATOM SMASHER

A new type atom smasher, capable of producing X-rays of 300,000,000 electron volts and which may ultimately produce billion-volt X-rays, is being built at the General Electric research laboratory, Schenectady, N. Y. Known as a "nonferromagnetic synchrotron," the device is being built under a contract with the Office of Naval Research and will be used for nuclear studies.

NEW TYPE CATHODE

A new type of cathode (source of electrons), which for a fraction of a second will generate nearly six times as much power in a vacuum tube as the largest power station in the United States, has been developed by Dr. Edward A. Coomes, professor of physics at the University of Notre Dame. The powerful cathode developed by Dr. Coomes is approximately 600 times more powerful than existed prior to the outbreak of World War II. Before the war, the most powerful cathodes were used in tubes capable of generating approximately ten kilowatts. The new cathode worked on by the Notre Dame scientist helped to make possible the development of electron tubes capable of generating approximately 6,000 kilowatts. The new cathode is usable only in situations in which the power is turned on and off within much less than one second, otherwise the power generated would melt the tube in which the cathode is used.

PROTECTIVE CLOTHING OF GLASS

Glass clothing impregnated with lead will allow rescue workers in an atomic war to rush into the "hot areas" after an atomic bomb burst. Developed by five Virginia doctors to protect X-ray workers from the radiation that causes deadly leukemia, the fibers of glass, heavy with protective lead, stop the "bullets" of dangerous radiation from atomic-bomb debris. The fibers of lead glass will not be made into protective clothing for wear in event of an atom bomb burst because it will not give protection against the intense, immediate radiation from the bomb itself. Only many feet of concrete or heavy thicknesses of metal such as lead, will protect against that. But the material will protect against the radiation coming from contaminated material and debris from the bomb after the burst.

Dr. Vincent W. Archer of the University of Virginia developed the new clothing while searching for better protection for X-ray workers than is given by the lead-impregnated rubber garments generally in use. The new material will comprise the sleeves and front of a protective apron-coat and will be of from 3- to 5-ply weave in the parts covering the arms and abdomen of the wearer, since these regions usually receive the most radiation.

NEW ATOMIC REACTOR

The experimental atomic power plant being built near West Milton, in Saratoga County, N. Y., will use liquid metal to transfer heat created by atomic fission to the heat exchanger, where steam will be produced to drive steam turbine generators. The reactor in the new plant will differ from most previous reactors in the higher energy of the neutrons, the atom-splitting particles which are produced in it by chain reaction in uranium.

Book Reviews

Review Staff

Brig. Gen. Donald Armstrong, *military historian, lecturer, author, manufacturer, Burlington, N. J.*

Col. George S. Brady, *consulting engineer, author, editor, Washington, D. C.*

F. W. Foster Gleason, *military historian, ordnance analyst, editor, Washington, D. C.*

Lieut. Col. Calvin Goddard, *small-arms authority, Tokyo, Japan.*

Lieut. Col. Melvin M. Johnson, Jr., *automatic arms expert, inventor, author, New Haven, Conn.*

Brig. Gen. R. H. Somers, *engineer, author, editor, Dover, N. H.*

Col. Thomas K. Vincent, *artillerist, engineer, author, Aberdeen Proving Ground, Md.*

Dr. John J. O'Connor, *educator, author, editor, Washington, D. C.*

Col. Philip Schwartz, *author, air ordnance expert, Headquarters, United States Air Force, Washington, D. C.*

El Alamein to the River Sangro. By Field Marshal the Viscount Montgomery, K.G., G.C.B., D.S.O. New York: E. P. Dutton & Company. 192 pp. $6.50.

THIS is a personal account by the commander of what Winston Churchill has described as "the immortal march of the Eighth Army." It is a terse, direct unfolding of the changing strategy that took a defeated army from before Alexandria, reactivated it, and led it against powerful opposition across North Africa and almost to Rome.

The early path up the Italian Peninsula was made easier by the help of the navy and the landing of Commandos behind the line of the retreating Germans. But this help was discontinued at a critical time when cold weather was coming on and the German forces were being strengthened. Thus, because the naval forces were withdrawn in preparation for the campaign in northern France, the Eighth Army was unable to exploit its advantages, prolonging the war in Italy where a speedy advance might have been made.

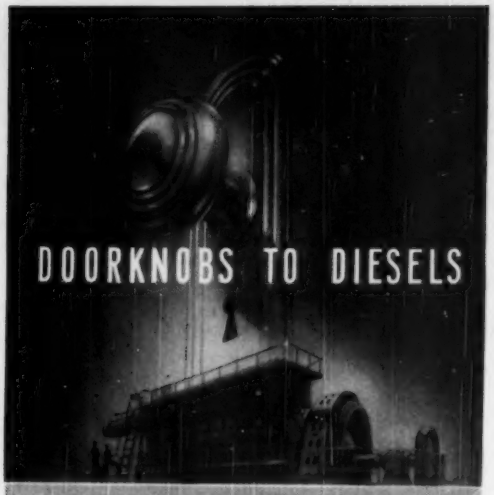
Montgomery states bluntly: "We were involved in a major campaign lacking a predetermined plan of action." He implies what others have suspected; namely, that the importance of the Italian campaign was not realized by a distant staff that was absorbed in advance planning for the cross-channel operation.

It is not a book for the average lay reader, but as a text of military strategy it is probably unrivaled.—George S. Brady.

Must We Hide? By R. E. Lapp. Cambridge: Addison-Wesley Press, Inc. 182 pp. $3.

THIS book is predicated on the belief, earlier expressed by Thomas Jefferson, that our citizens are competent to decide and act if fully informed. It is an attempt to place the atomic bomb in proper perspective, while complying with all security regulations. There is need for public awareness of the dangers we face.

The author discusses atomic attack and atomic casualties and draws conclusions as to the relative effectiveness of air bursts and underwater detonations of the A-bomb. In this section of



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the book are many illustrations showing the effects of radiation on personnel.

With charts, photographs, and statistics the author compares the bombing of Germany and the destruction of Japan. His discussion of the bomb-delivery problem and that of active defense shows a very thorough understanding of air, military, and naval power.

While in all his descriptions of atomic-bomb detonations, either experimental or combat, he draws conclusions somewhat less frightening than those printed in the earlier literature, he sees no occasion for complacency on our part. Instead, we should maintain a high state of preparedness and take immediate steps to inform and to train the public. If not there is great danger from the psychologic effects of the bomb.

Both city planners and industrial leaders will find much of value in his able discussion of protective measures and dispersion. This portion of the book gives an excellent evaluation of the various parts of our country from the standpoint of target effectiveness.

This is the best attempt so far to evaluate "The Bomb" as a weapon of war, giving correct weight to each of the combat arms—air, ground, and sea. There is also an excellent discussion of war aims and objectives.

This book should be read by all who desire a complete picture of The Bomb—its potentialities and its dangers. Every citizen should inform himself of the facts of atomic warfare in all its ramifications.—C. D. BILLMYER.

Bataan Uncensored. By Col. E. B. Miller. Long Prarie, Minn.: Hart Publications, Inc. 403 pp. $4.50.

WRITTEN by a citizen-soldier with thirty-one years' experience in the National Guard (and service in both World Wars), this is a book of criticism—strong, even bitter, but not vituperative nor petty, and carrying with it well-reasoned answers. In the main, it is not criticism of individuals but of a system. Nor is it based upon isolated incidents but upon a factual account of red tape and a whole series of stupidities.

Colonel Miller begins the volume with an incident which forms a shocking indictment of the entire "army system." More than one hundred empty trucks—coming from Manila with its bulging warehouses—rolled past him into the Bataan Peninsula fifteen days after the first Jap attack! Evidence of a lack of firm planning, especially in logistics, is piled high, and also lack of elementary security in communications, coupled with the usual "security red tape."

The author's respect for military history is profound, and he gives America's ignorance of this study as the chief cause of the moral and material unpreparedness of the country. He really understands tank warfare, and the tank's chief enemy is revealed as the enthusiast who sold the idea that "it could do anything." Ordnance is not neglected. Miller agrees that the Ordnance Department turned out what was required of it, but does criticize it for failing to lead in weapons thought.

A large part of the volume is devoted to the prison camps of Japan. Interesting in itself, its chief value is in the explanation of the "counterclockwise psychology" of the Jap. Its summary is worth memorizing and storing for future use.

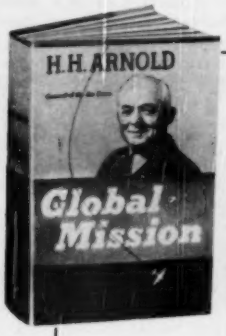
The real message, however, of "Bataan Uncensored" is the meaning of unpreparedness. And Colonel Miller's "Program for National Defense," offered at the book's conclusion, is the fruit of both battle and thought.—F. W. F. GLEASON.

Saint-Vith: Lion in the Way. By Col. R. Ernest Dupuy. Washington: Infantry Journal Press. 252 pp. $5.

HERE is a factual history of the 106th Division of our Army. The brief account of its formation, its training, and subsequent

AMERICAN ORDNANCE ASSOCIATION

Book of the Month for SEPTEMBER



GLOBAL MISSION

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On all orders received *before* September 19, 1949, the retail price is $4.50; to members, $4.05. Orders received *after* September 19th will be $5.00 retail, $4.50 to members.

STRATEGIC AIR POWER

By Dr. Stefan T. Possony

This thorough, unbiased study of air power shows clearly the principles, possibilities, and limitations of strategic bombing, the relation of air power to the important elements of land and sea power, and the status of strategic air power as a first line of defense. Dr. Possony, one of America's keenest military students, explains exactly what strategic air power has accomplished, what it means to us now, and what changes in aërial warfare may be expected in the atomic age. Retail $5.00. To members $4.50.

RECOMMENDED BOOKS

WAR YEARS WITH JEB STUART

By Lieut. Col. W. W. Blackford, C.S.A.

This is that rare thing—"an interesting military biography." Written during the exciting days of the Civil War, the manuscript has recently been released for publication by the author's descendants. It is a dashing account of battles, raids, and sieges with a foreword by Douglas Southall Freeman. Retail $3.50. To members $3.15.

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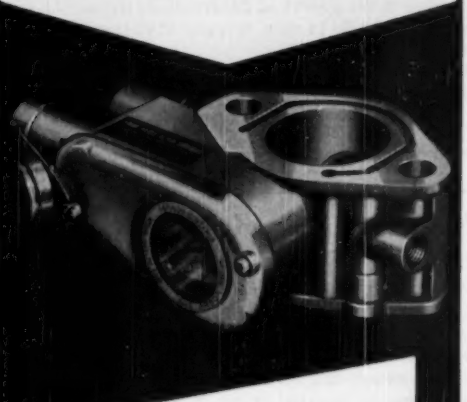

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fortune is the old, old story of military life in a democracy when war calls. At the height of its efficiency, more than fifty per cent of its trained personnel were assigned elsewhere, their vacancies were filled with green replacements, and then the division was sent immediately overseas to the theater of operations.

The 106th was in the Battle of the Bulge where its mission was the defense of Saint-Vith, the focal point of five roads and three railroads. Its task was to deny the Germans this key point if at all possible and to delay them at all costs. The division was successful in carrying out its mission and slowed up the German advance which helped make the reversal of the Bulge battle possible.

Here is a factual account, written by an historian in possession of the records and familiar with the situation. He spares no one, he names names, he gives credit where due, and the reader has the assurance of truth when reading the book. The result is a history of which any division could be well proud.—T. K. VINCENT.

The War of 1812. By Francis Beirne. New York: E. P. Dutton and Company. 410 pp. $5.

THOUGH frequently called "America's Second War for Independence," this war is one of the more flagrant gaps in our recorded military history. Mr. Beirne, writing with discernment and considerable dry humor, has given us a popular yet reasonably documented account of the war as a whole which goes far toward closing the breach.

Skillfully he relates the almost incredibly devious, cowardly, and blundering diplomacy which led to war—and the fatal military weakness which made it inevitable. (Gouverneur Morris stated: "Had we twenty sail of the line, 1812 would never have been fought.") The political and diplomatic course of the struggle, with all its contradiction and confusion, is excellently handled. Military events are well recorded, though an occasional weakness in their evaluation can be detected. The volume is without illustration, but there are first-class maps of all important actions, and an index adds to its usefulness. The "Conclusion" is brilliant and sound. It ties the lessons of 1812 to all of America's subsequent dealings with Europe's conflicts, and demonstrates conclusively that moral and military strength is the only key to our peace.

The book has but one real weakness—its treatment of ordnance is not only scant but deceptive. Designating the fifteen 42-pounders of Fort McHenry as "32-pounders," exaggerating the range of small field rockets, even speaking of Indian musketry as "deadly rifle fire" may be of small moment. But consistently imputing to the common field and naval gun of 1812-1814 the practice of using explosive shell as well as solid ball, is a somewhat egregious error. However, we of the ordnance fraternity must admit that we have offered little in the way of appropriate published information to assist the historical writer.—F. W. F. GLEASON.

Basic Radio Principles. By Maurice Grayle Suffern. New York: McGraw-Hill Book Company. 271 pp.

THIS is a manual designed to aid in the training of radio repairmen and technicians on a vocational-educational level in a period of approximately 200 hours. The basic facts of radio theory have been expressed as simply as possible. There has been no attempt to approach the higher, technical-education level involving a knowledge of mathematics and physics. In short, it is an excellent manual for the student who has a basic knowledge of the principles of electricity and wants to prepare himself for radio work.—JOHN J. O'CONNOR.

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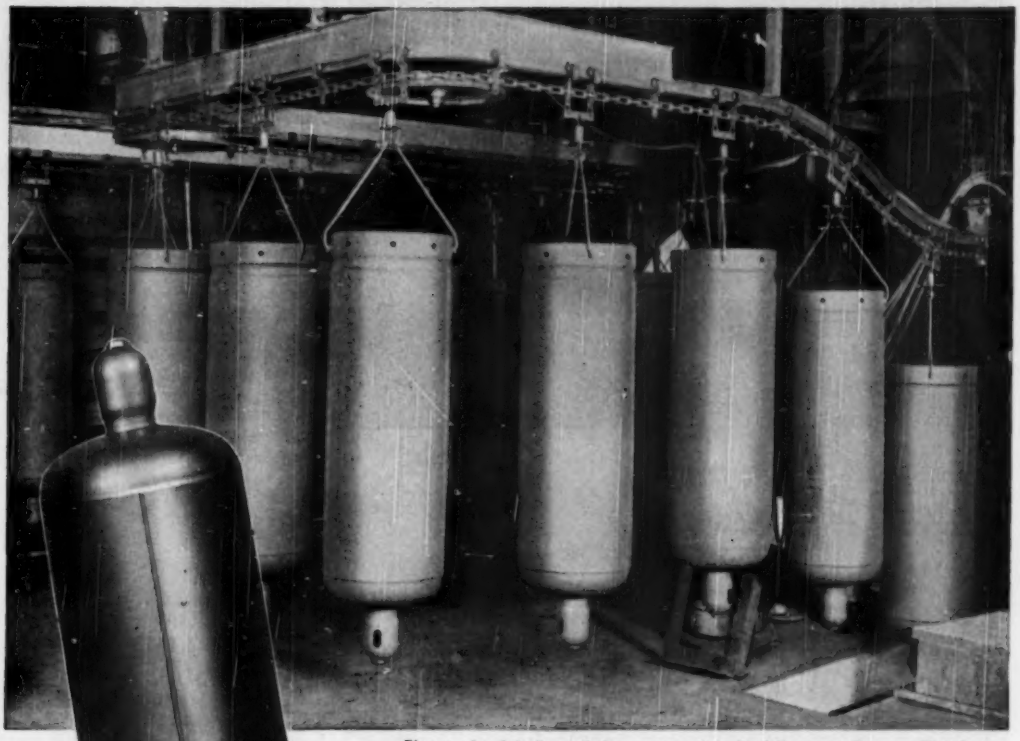

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Book Reviews

Democracy and Progress. By David McCord Wright. New York: The Macmillan Company. 220 pp. $3.50.

THIS book does not claim to have the one and only answer to the multitude of social and economic problems brought forth by today's technical advances. It is, however, a challenge to those of us who believe in and desire to perpetuate the way of life which has made us a strong and vigorous nation.

The author, thoroughly imbued with the principles of Thomas Jefferson, in turn studied architecture, law, and economics. Though he ranges over a wide field including business cycles, investment, distribution of wealth, trade unions, taxation, and even education, he steers a middle course.

The author takes the position that our form of free enterprise is necessary to the preservation of democracy in political and social life. Without the perpetual election afforded by the competitive pricing system we would not have the industrial progress necessary to continue our growth.

Rather than agree with the ultraliberal critic who contends that the unequal distribution of wealth proves that our system of modified capitalism is not democratic, Professor Wright states his belief that our system allows each customer to vote for or against a product each time he purchases or decides not to do so.

He warns us to fight continually against the totalitarian pressures in modern society, a trend which other men see in education, industry, and government. Although industrial leaders see the dangers involved, and some, like C. R. Braun and C. E. Wilson, are trying to do something about it, much more remains to be done.—C. D. BILLMYER.

The 84th Infantry Division in the Battle of Germany. By Lieut. Theodore Draper. New York: Viking Press. 260 pp. $5.

THIS STORY of battle experience of the men of the 84th Division was prepared and written by their own historical section. Its place among war records is therefore almost unique, for it is based upon hundreds of interviews during and immediately after combat; then carefully checked with official records.

While the book is of greatest interest to veterans of the 84th and makes no pretense of picturing the war as a whole, it offers a detailed study of modern warfare which is necessarily lacking in histories of larger coverage. Hundreds of photographs and drawings (some colored) add to the graphic worth. Numerous maps enable the reader to follow battle movements.—F. W. F. GLEASON.

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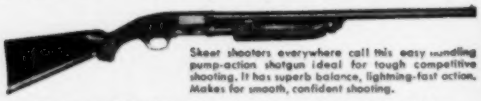

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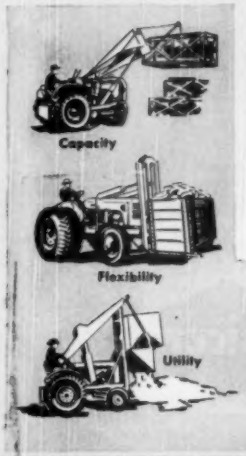

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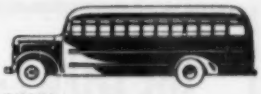

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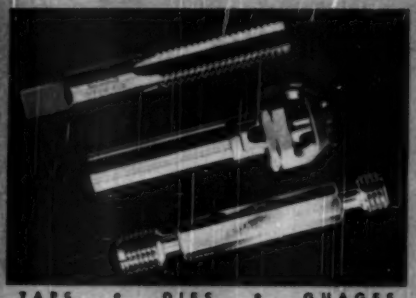

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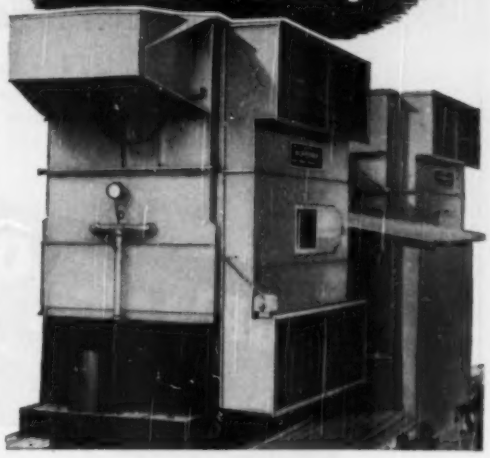

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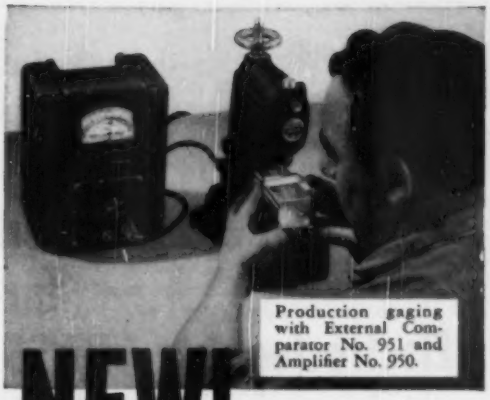

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[ORDNANCE—*composition, presswork, and binding—is the work of The William Byrd Press, Inc., Richmond, Va.*]

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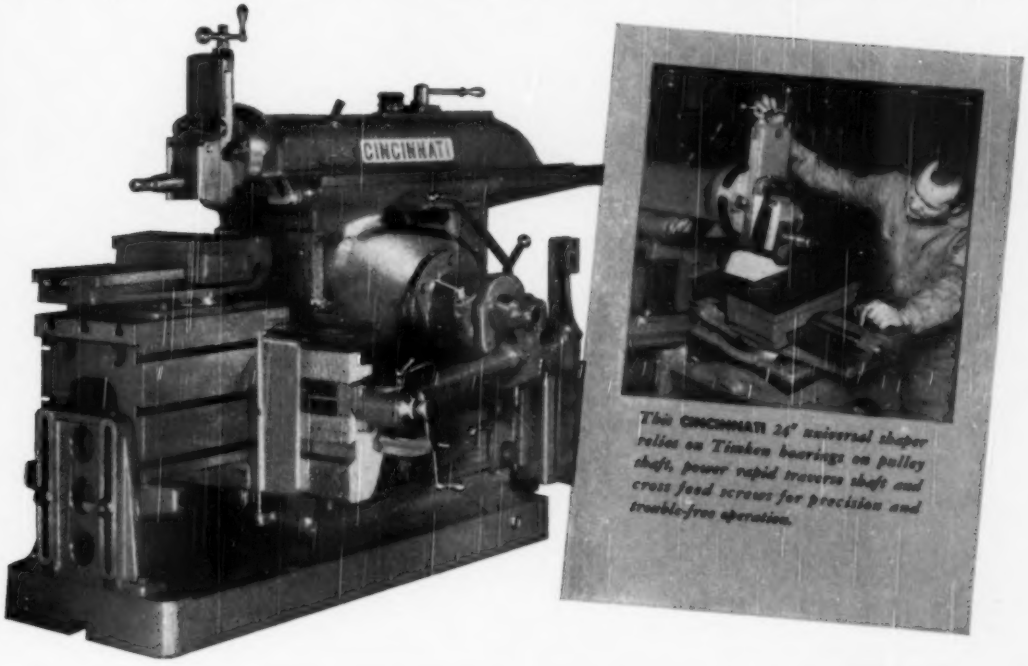

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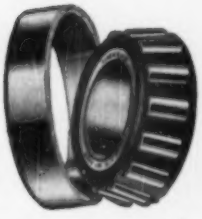

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VOL. XXXIV, No. 176 • SECTION II • SEPTEMBER-OCTOBER, 1949

To Keep America Strong for Peace

In this section are published the names of the officials of the American Ordnance Association—officers, members of Council, the Board of Directors, Executive Committee, and Advisory Board. Also listed here are the local Posts of the Association with their officers and directors; likewise the membership of the National Technical Divisions and Committees of the A.O.A. Section II concludes with the Honor Roll of Industrial Preparedness whereon are inscribed the names of the Company Members of the American Ordnance Association.

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INTERNATIONAL HARVESTER COMPANY . . CHICAGO
INTERNATIONAL NICKEL COMPANY . HUNTINGTON
INTERNATIONAL SILVER COMPANY . . . . MERIDEN
IONIA MANUFACTURING COMPANY . . . . IONIA
ITHACA GUN COMPANY . . . . . ITHACA

JACKSON AND CHURCH COMPANY . . . . SAGINAW
JACKSONVILLE METAL MANUFACTURING COMPANY . . . . . JACKSONVILLE
JACOBS COMPANY, F. L. . . . . DETROIT
JIG BUSHING COMPANY . . . . . PONTIAC
JOA, INC., CURT G. . . . . SHEBOYGAN
JOHNS-MANVILLE SALES CORPORATION . NEW YORK
JONES & LAMSON MACHINE COMPANY . . SPRINGFIELD
JONES & LAUGHLIN STEEL CORPORATION . PITTSBURGH

KABLE BROTHERS COMPANY . . . MOUNT MORRIS
KAHN ASSOCIATED ARCHITECTS AND ENGINEERS, INC., ALBERT . . . . . DETROIT
KAYDON ENGINEERING CORPORATION . . MUSKEGON
KEARNEY & TRECKER CORPORATION . . WEST ALLIS
KELLOGG COMPANY, M. W. . . . . NEW YORK
KELLY-SPRINGFIELD TIRE COMPANY . CUMBERLAND
KELSEY-HAYES WHEEL COMPANY . . . . DETROIT
KENNAMETAL, INC. . . . . LATROBE
KENNEDY-VAN SAUN MANUFACTURING & ENGINEERING COMPANY . . . . . DANVILLE
KENWORTH MOTOR TRUCK CORPORATION . . SEATTLE
KEUFFEL & ESSER COMPANY . . . . HOBOKEN
KEYSTONE MANUFACTURING COMPANY . . BOSTON
KIDDE & COMPANY, WALTER . . . . BELLEVILLE
KIFFER TOOL AND DIE, INCORPORATED . CLEVELAND
KILGORE MANUFACTURING COMPANY . WESTERVILLE
KING-SEELEY CORPORATION . . . . ANN ARBOR
KINGSBURY MACHINE TOOL CORPORATION . KEENE
KNAPP-MONARCH COMPANY . . . . ST. LOUIS
KOEHRING COMPANY . . . . . MILWAUKEE
KOHLER COMPANY . . . . . KOHLER
KOPPERS COMPANY . . . . . PITTSBURGH

LAKE CITY MALLEABLE IRON COMPANY . CLEVELAND
LAMSON CORPORATION . . . . . SYRACUSE
LANOVA CORPORATION . . . . LONG ISLAND CITY
LANSDOWNE STEEL & IRON COMPANY . . . MORTON
LAPOINTE MACHINE TOOL COMPANY . . . HUDSON
LEBANON STEEL FOUNDRY . . . . . LEBANON
LEE TIRE & RUBBER COMPANY OF NEW YORK, INC. . . . . CONSHOHOCKEN
LEEDS & NORTHRUP COMPANY . . . PHILADELPHIA
LEHIGH FOUNDRIES, INC. . . . . EASTON
LIBBEY-OWENS-FORD GLASS COMPANY . . . TOLEDO
LIEBERKNECHT, INC., KARL . . . . . READING
LIMA-HAMILTON CORPORATION . . . . LIMA
LINCOLN BRASS WORKS, INC. . . . . DETROIT
LINCOLN ELECTRIC COMPANY . . . . CLEVELAND
LINCOLN ENGINEERING COMPANY . . . ST. LOUIS
LINE MATERIAL COMPANY . . . . . MILWAUKEE
LINK-BELT COMPANY . . . . . CHICAGO
LITTLE, INC., ARTHUR D. . . . . CAMBRIDGE
LOUISIANA POWER & LIGHT COMPANY . NEW ORLEANS
LUKENS STEEL COMPANY . . . . . COATESVILLE
LYNCHBURG FOUNDRY COMPANY . . . LYNCHBURG

MACK MANUFACTURING CORPORATION . NEW YORK
MANSFIELD TIRE & RUBBER COMPANY . . MANSFIELD
MARLIN-ROCKWELL CORPORATION . . . JAMESTOWN
MARMON-HERRINGTON COMPANY . . INDIANAPOLIS
MASLAND & SONS, C. H. . . . . CARLISLE
MASON & HANGER COMPANY . . . . NEW YORK
MATHEWS CONVEYOR COMPANY . . ELLWOOD CITY
MATTHEWS CORPORATION, W. N. . . . ST. LOUIS
MAXSON CORPORATION, W. L. . . . . NEW YORK
MAYTAG COMPANY . . . . . NEWTON
MCCAULEY METAL PRODUCTS, INC. . . . BUFFALO
MCCONWAY & TORLEY CORPORATION . . PITTSBURGH
MCDOWELL MANUFACTURING COMPANY . PITTSBURGH
MCINERNEY SPRING & WIRE COMPANY GRAND RAPIDS
MCKAY COMPANY . . . . . PITTSBURGH
MCKINNEY & SON, INC., JAMES . . . . ALBANY
MCQUAY-NORRIS MANUFACTURING COMPANY ST. LOUIS
MECHANICAL HANDLING SYSTEMS, INC. . . DETROIT
MELCHOIR, ARMSTRONG, DESSAU COMPANY OF DELAWARE, INC. . . . . RIDGEFIELD
MERCK & COMPANY . . . . . RAHWAY
MERGENTHALER LINOTYPE COMPANY . . BROOKLYN
MERZ ENGINEERING COMPANY . . . INDIANAPOLIS
METAL PRODUCTS CORPORATION . . . . MIAMI
METROLOY CORPORATION . . . . NEW ROCHELLE
METROPOLITAN BODY COMPANY . . . BRIDGEPORT
MEYER MANUFACTURING COMPANY, GEO. J. . . . . CUDAHY
MICA INSULATOR COMPANY . . . . NEW YORK
MICHIGAN STEEL CASTING COMPANY . . . DETROIT
MIDVALE COMPANY . . . . . PHILADELPHIA
MIDWEST PIPING AND SUPPLY COMPANY . ST. LOUIS
MILCO UNDERGARMENT COMPANY . . . BLOOMSBURG
MILLER ELECTRIC COMPANY . . . JACKSONVILLE
MILLER MANUFACTURING COMPANY . . . DETROIT
MILLER PRINTING MACHINERY COMPANY . PITTSBURGH
MILSCO MANUFACTURING COMPANY . . MILWAUKEE
MINES EQUIPMENT COMPANY . . . . ST. LOUIS
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY . . . . . MINNEAPOLIS
MINNEAPOLIS-MOLINE POWER IMPLEMENT COMPANY . . . . . MINNEAPOLIS
MISSISSIPPI RIVER FUEL CORPORATION . ST. LOUIS
MISSISSIPPI VALLEY BARGE LINE COMPANY ST. LOUIS
MONARCH ALUMINUM MFG. COMPANY . . CLEVELAND
MONARCH MARKING SYSTEM COMPANY . . DAYTON
MONARCH RUBBER COMPANY . . . . HARTVILLE
MONITOR CONTROLLER COMPANY . . . . BOSTON
MONROE AUTO EQUIPMENT COMPANY . . . MONROE
MONROE CALCULATING MACHINE COMPANY . ORANGE
MONTGOMERY ELEVATOR COMPANY . . . MOLINE
MONTPELIER MANUFACTURING COMPANY . MONTPELIER
MOORE DROP FORGING COMPANY . . . SPRINGFIELD

Honor Roll of Industrial Preparedness

MOORE ENAMELING & MANUFACTURING COMPANY . . . . . WEST LAFAYETTE
MOREY MACHINERY COMPANY . . . . NEW YORK
MORRISON STEEL PRODUCTS, INC. . . . . BUFFALO
MOSLER SAFE COMPANY . . . . . HAMILTON
MOTO-MOWER COMPANY . . . . . DETROIT
MOTOR WHEEL CORPORATION . . . . . LANSING
MULLINS MANUFACTURING CORPORATION . . SALEM
MUNCIE GEAR WORKS, INC. . . . . MUNCIE
MUNSINGWEAR, INC. . . . . MINNEAPOLIS
MURRAY MANUFACTURING COMPANY, D. J. . WAUSAU
MURRAY MANUFACTURING CORPORATION . BROOKLYN
MURRAY OHIO MANUFACTURING COMPANY CLEVELAND

NAGEL-CHASE MANUFACTURING COMPANY . CHICAGO
NARROW FABRIC COMPANY . . . . . READING
NASH ENGINEERING COMPANY . . SOUTH NORWALK
NASH-KELVINATOR CORPORATION . . . . DETROIT
NATIONAL ACME COMPANY . . . . . CLEVELAND
NATIONAL ASSOCIATION OF INSURANCE AGENTS . . . . . NEW YORK
NATIONAL AUTOMOTIVE FIBRES, INC. . . . DETROIT
NATIONAL BATTERY COMPANY . . . . . ST. PAUL
NATIONAL BROACH & MACHINE COMPANY . . DETROIT
NATIONAL CASH REGISTER COMPANY . . . DAYTON
NATIONAL ENAMELING & STAMPING COMPANY . . . . . MILWAUKEE
NATIONAL GYPSUM COMPANY . . . . . BUFFALO
NATIONAL LOCK WASHER COMPANY . . . NEWARK
NATIONAL MACHINERY COMPANY . . . . TIFFIN
NATIONAL MALLEABLE & STEEL CASTINGS COMPANY . . . . . CLEVELAND
NATIONAL PNEUMATIC COMPANY . . . . RAHWAY
NATIONAL POWDER COMPANY . . . . . ELDRED
NATIONAL RADIATOR COMPANY . . . JOHNSTOWN
NATIONAL RESEARCH CORPORATION . . CAMBRIDGE
NATIONAL SCREW & MANUFACTURING COMPANY . . . . . CLEVELAND
NATIONAL SLUG REJECTORS, INC. . . . ST. LOUIS
NATIONAL STAMPING COMPANY . . . . DETROIT
NATIONAL STAMPING & ELECTRIC WORKS . . CHICAGO
NATIONAL SUPPLY COMPANY . . . . PITTSBURGH
NATIONAL TOOL SALVAGE COMPANY . . . DETROIT
NATIONAL TUBE COMPANY . . . . . PITTSBURGH
NEAPCO PRODUCTS, INC. . . . . POTTSTOWN
NELSON SPECIALTY CORPORATION . . SAN LEANDRO
NEW BRITAIN MACHINE COMPANY . . NEW BRITAIN
NEW ENGLAND BOX COMPANY . . . . GREENFIELD
NEW ENGLAND BRASS COMPANY . . . TAUNTON
NEW PROCESS GEAR CORPORATION . . SYRACUSE
NEW YORK AIR BRAKE COMPANY . . . NEW YORK
NEWARK STOVE COMPANY . . . . . NEWARK
NEWPORT STEEL CORPORATION . . . . DETROIT
NIEDRINGHAUS METAL PRODUCTS COMPANY . . . . . ST. LOUIS
NINETEEN HUNDRED CORPORATION . . ST. JOSEPH
NOBLE & COMPANY, F. H. . . . . CHICAGO
NOLL EQUIPMENT COMPANY . . . . CLEVELAND
NORDBERG MANUFACTURING COMPANY . MILWAUKEE
NORQUIST PRODUCTS, INC. . . . . JAMESTOWN
NORRIS STAMPING & MANUFACTURING COMPANY . . . . . LOS ANGELES
NORTHFIELD FOUNDRY & MACHINE COMPANY . . . . . NORTHFIELD
NORTHWEST AUTOMATIC PRODUCTS CORPORATION . . . . . MINNEAPOLIS
NORTON COMPANY . . . . . WORCESTER

OAKITE PRODUCTS, INC. . . . . NEW YORK
OCEAN CITY MANUFACTURING COMPANY PHILADELPHIA
OHIO RUBBER COMPANY . . . . WILLOUGHBY
OHIO STEEL FOUNDRY COMPANY . . . . LIMA
OILGEAR COMPANY . . . . . MILWAUKEE
O'KEEFE & MERRITT COMPANY . . . LOS ANGELES
OLD TRAIL MOTORS, INC. . . . . WASHINGTON
OLDSMOBILE DIVISION, GMC . . . . . LANSING
OLIN INDUSTRIES, INC. . . . . EAST ALTON
OLIVER CORPORATION . . . . . CHICAGO
OLIVER IRON AND STEEL CORPORATION . PITTSBURGH
ONONDAGA POTTERY COMPANY . . . SYRACUSE
OPW CORPORATION . . . . . CINCINNATI
ORLEANS MATERIALS & EQUIPMENT COMPANY . . . . . NEW ORLEANS
OTIS ELEVATOR COMPANY . . . . . NEW YORK
OVERLY MANUFACTURING COMPANY . . GREENSBURG
OWENS-ILLINOIS GLASS COMPANY . . . . TOLEDO

PACIFIC CAR AND FOUNDRY COMPANY . . RENTON
PACKARD MOTOR CAR COMPANY . . . . DETROIT
PARISH PRESSED STEEL COMPANY . . . READING
PARKER RUST-PROOF COMPANY . . . . DETROIT
PASS & SEYMOUR, INC. . . . . SYRACUSE
PECO MANUFACTURING CORPORATION . PHILADELPHIA
PEMCO CORPORATION . . . . . BALTIMORE
PENNSYLVANIA TRANSFORMER COMPANY . PITTSBURGH
PERFEX CORPORATION . . . . . MILWAUKEE
PFIZER & COMPANY, CHARLES . . . . NEW YORK
PHELPS DODGE COPPER PRODUCTS CORPORATION . . . . . NEW YORK
PHEOLL MANUFACTURING COMPANY . . . CHICAGO
PHILCO CORPORATION . . . . . PHILADELPHIA
PITTSBURGH FORGINGS COMPANY . . . CORAOPOLIS
PITTSBURGH STEEL COMPANY . . . . PITTSBURGH
PLUMB, INC., FAYETTE R. . . . . PHILADELPHIA
PLUME & ATWOOD MANUFACTURING COMPANY . . . . . WATERBURY
PLYMOUTH MOTOR CORPORATION . . . . DETROIT
POLORON PRODUCTS, INC. . . . . NEW ROCHELLE
PONTIAC MOTOR DIVISION, GMC . . . . PONTIAC
PONTIAC VARNISH COMPANY . . . . . PONTIAC
POOR & COMPANY . . . . . CHICAGO
POPPER, INC., J. S. . . . . UNION CITY
PORTER COMPANY, H. K. . . . . PITTSBURGH
PRATT & WHITNEY DIVISION, NILES-BEMENT-POND COMPANY . WEST HARTFORD
PRECISION CASTINGS COMPANY . . . SYRACUSE
PRENTISS WABERS PRODUCTS CO. . WISCONSIN RAPIDS
PRESSED STEEL CAR COMPANY . . . . PITTSBURGH
PROCTER & GAMBLE COMPANY . . . . CINCINNATI
PULLMAN-STANDARD CAR MANUFACTURING COMPANY . . . . . CHICAGO
PYLE-NATIONAL COMPANY . . . . . CHICAGO

QUALITY GASKET & MANUFACTURING COMPANY . . . . . DETROIT

Honor Roll of Industrial Preparedness

RATHBORNE HAIR & RIDGWAY COMPANY . . CHICAGO
RAYNER LITHOGRAPHING COMPANY . . . CHICAGO
RAYTHEON MANUFACTURING COMPANY . WALTHAM
RCA VICTOR DIVISION, RADIO CORP. OF AMERICA . . . . . CAMDEN
READING BATTERIES, INC. . . . . READING
REEVES BROTHERS, INC. . . . . NEW YORK
REEVES INSTRUMENT CORPORATION . . NEW YORK
REGINA CORPORATION . . . . . RAHWAY
REMINGTON ARMS COMPANY . . . . BRIDGEPORT
REMINGTON RAND, INC. . . . . STAMFORD
REO MOTORS, INC. . . . . LANSING
REPUBLIC STAMPING & ENAMELING CO. . . CANTON
REPUBLIC STEEL CORPORATION . . . CLEVELAND
REVERE COPPER & BRASS, INC. . . . NEW YORK
REYNOLDS METALS COMPANY . . . . RICHMOND
REYNOLDS SPRING COMPANY . . . . . JACKSON
RHEEM MANUFACTURING COMPANY . . NEW YORK
RICHFIELD OIL CORPORATION . . . LOS ANGELES
RICHMOND ENGINEERING COMPANY . . RICHMOND
ROBBINS ENGINEERING COMPANY . . . . DETROIT
ROBERTSHAW-FULTON CONTROLS CO. . . GREENSBURG
ROCHESTER PRODUCTS DIVISION, GMC . . ROCHESTER
ROCKWOOD SPRINKLER COMPANY OF MASSACHUSETTS . . . . . WORCESTER
RODGERS HYDRAULIC, INC. . . . . MINNEAPOLIS
ROHM & HAAS COMPANY . . . . . DETROIT
ROPER CORPORATION, GEO. D. . . . . ROCKFORD
ROSS CARRIER COMPANY . . . BENTON HARBOR
ROSS GEAR AND TOOL COMPANY . . . LAFAYETTE
ROSS-MEEHAN FOUNDRIES . . . . CHATTANOOGA
ROYAL TYPEWRITER COMPANY . . . . HARTFORD
RUDEL MACHINERY COMPANY . . . . NEW YORK
RUSSELL MANUFACTURING COMPANY . . MIDDLETON
RUSTLESS IRON & STEEL DIVISION, ARMCO STEEL CORPORATION . . . . . BALTIMORE

SAE STEELS . . . . . CLEVELAND
SAFRAN PRINTING COMPANY . . . . . DETROIT
SAGINAW MALLEABLE IRON DIVISION, GMC . SAGINAW
SAGINAW STEERING GEAR DIVISION, GMC . . SAGINAW
ST. CHARLES MANUFACTURING COMPANY . ST. CHARLES
ST. CLAIR RUBBER COMPANY . . . . DETROIT
ST. LOUIS CAR COMPANY . . . . . ST. LOUIS
SALEM ENGINEERING COMPANY . . . . SALEM
SANDERSON & PORTER . . . . . NEW YORK
SANDPAPER INCORPORATED . . . . ROCKLAND
SAVAGE ARMS CORPORATION . . . . . UTICA
SCAIFE COMPANY . . . . . OAKMONT
SCHLAGE LOCK COMPANY . . . . SAN FRANCISCO
SCHLEGEL MANUFACTURING COMPANY . ROCHESTER
SCHLITZ BREWING COMPANY, JOSEPH . . MILWAUKEE
SCHLUETER MANUFACTURING COMPANY . ST. LOUIS
SCHWITZER-CUMMINS COMPANY . . INDIANAPOLIS
SCOVILL MANUFACTURING COMPANY . . WATERBURY
SCULLIN STEEL COMPANY . . . . . ST. LOUIS
SEEGER REFRIGERATOR COMPANY . . . ST. PAUL
SELMER, INC., H. & A. . . . . NEW CASTLE
SERVEL, INC. . . . . EVANSVILLE
SHEAFFER PEN COMPANY, W. A. . . FORT MADISON
SHEFFIELD CORPORATION . . . . . DAYTON
SHELL OIL COMPANY . . . . . DETROIT
SHERWIN-WILLIAMS COMPANY . . . . CLEVELAND
SILAS MASON COMPANY . . . . . SHREVEPORT
SILENT GLOW OIL BURNER CORPORATION . HARTFORD
SIMMONS COMPANY . . . . . NEW YORK
SIMONDS SAW & STEEL COMPANY . . . FITCHBURG
SIMPLEX MANUFACTURING CORPORATION NEW ORLEANS
SINGER MANUFACTURING COMPANY . ELIZABETHPORT
SIVYER STEEL CASTING COMPANY . . . MILWAUKEE
SKF INDUSTRIES, INC. . . . . PHILADELPHIA
SMIT & COMPANY, ANTON . . . . . NEW YORK
SMITH CORPORATION, A. O. . . . . MILWAUKEE
SMITH & CORONA TYPEWRITERS, INC., L. C. SYRACUSE
SMITH & WESSON, INC. . . . . SPRINGFIELD
SMITH, DRUM & COMPANY . . . . PHILADELPHIA
SMITH MANUFACTURING COMPANY, F. A. . ROCHESTER
SNYDER MANUFACTURING COMPANY, H. P. LITTLE FALLS
SOUTH BEND LATHE WORKS . . . . SOUTH BEND
SOUTH CHESTER TUBE COMPANY . . . . CHESTER
SOUTHERN COACH MANUFACTURING CO. . EVERGREEN
SOUTHERN NATURAL GAS COMPANY . . BIRMINGHAM
SPEED-O-PRINT CORPORATION . . . . . CHICAGO
SPENCER CHEMICAL COMPANY . . . KANSAS CITY
SPERRY GYROSCOPE COMPANY . . . . GREAT NECK
SPICER MANUFACTURING DIVISION, DANA CORPORATION . . . . . TOLEDO
SPONGE RUBBER PRODUCTS COMPANY . . . SHELTON
SQUARE D COMPANY . . . . . DETROIT
STANDARD CONTAINER, INC. . . . . MONTCLAIR
STANDARD FORGINGS CORPORATION . . . CHICAGO
STANDARD PRESSED STEEL COMPANY . JENKINTOWN
STANDARD PRODUCTS COMPANY . . . . DETROIT
STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY . . . . . CHICAGO
STANDARD STEEL SPRING COMPANY . . CORAOPOLIS
STANDARD STOKER COMPANY . . . . NEW YORK
STANDARD TUBE COMPANY . . . . . DETROIT
STARLINE, INC. . . . . HARVARD
STEARNS-ROGER MANUFACTURING COMPANY . DENVER
STERLING MOTOR TRUCK COMPANY . . MILWAUKEE
STEWART-WARNER CORPORATION . . . . CHICAGO
STOCKHAM PIPE FITTINGS COMPANY . . BIRMINGHAM
STONE & WEBSTER ENGINEERING CORPORATION . . . . . NEW YORK
STONER MANUFACTURING CORPORATION . . AURORA
STREICHER DIE & TOOL COMPANY . . . YPSILANTI
STRELINGER COMPANY, CHAS. A. . . . . DETROIT
STUART OIL COMPANY, D. A. . . . . CHICAGO
STUDEBAKER CORPORATION . . . . SOUTH BEND
SUN ELECTRIC CORPORATION . . . . . CHICAGO
SUN OIL COMPANY . . . . . PHILADELPHIA
SUPERIOR COACH CORPORATION . . . . . LIMA
SUPERIOR STEEL CORPORATION . . . CARNEGIE
SURFACE COMBUSTION CORPORATION . . . TOLEDO
SUSQUEHANNA MILLS, INC. . . . . NEW YORK
SWANK, INC. . . . . ATTLEBORO
SYLVANIA ELECTRIC PRODUCTS, INC. . . NEW YORK
SYMINGTON-GOULD CORPORATION . . . ROCHESTER

TABER INSTRUMENT CORPORATION NORTH TONAWANDA
TALON, INC. . . . . MEADVILLE
TENNESSEE COAL, IRON AND RAILROAD CO. BIRMINGHAM

Honor Roll of Industrial Preparedness

TENNESSEE CORPORATION . . . . . NEW YORK
TEXAS GULF SULPHUR COMPANY . . . NEW YORK
TEXTILE MACHINE WORKS . . . . . READING
TEXTILEATHER CORPORATION . . . . . TOLEDO
THEW SHOVEL COMPANY . . . . . LORAIN
THIOKOL CORPORATION . . . . . TRENTON
THOMPSON PRODUCTS, INC. . . . . CLEVELAND
TIMKEN-DETROIT AXLE COMPANY . . . . DETROIT
TIMKEN ROLLER BEARING COMPANY . . . CANTON
TIMMS SPRING COMPANY . . . . . ELYRIA
TITAN METAL MANUFACTURING COMPANY . BELLEFONTE
TITEFLEX, INC. . . . . NEWARK
TOKHEIM OIL TANK AND PUMP COMPANY . FORT WAYNE
TOLEDO SCALE COMPANY . . . . . TOLEDO
TRACTOMOTIVE CORPORATION . . . . DEERFIELD
TRAILMOBILE COMPANY . . . . . CINCINNATI
TREADWELL CONSTRUCTION COMPANY . . MIDLAND
TREDEGAR COMPANY . . . . . RICHMOND
TRI-CLOVER MACHINE COMPANY . . . . KENOSHA
TRICO PRODUCTS CORPORATION . . . . BUFFALO
TROJAN POWDER COMPANY . . . . . ALLENTOWN
TROPIC-AIRE, INC. . . . . CHICAGO
TUBE REDUCING CORPORATION . . . . WALLINGTON
TULSA WINCH DIVISION, VICKERS, INC. . . TULSA
TURNER BRASS WORKS . . . . . SYCAMORE
TWIN DISC CLUTCH COMPANY . . . . . RACINE

UDYLITE CORPORATION . . . . . DETROIT
UNDERWOOD CORPORATION . . . . NEW YORK
UNEXCELLED CHEMICAL CORPORATION . NEW YORK
UNION BAG & PAPER CORPORATION . . NEW YORK
UNION CARBIDE AND CARBON CORP. . . NEW YORK
UNION METAL MANUFACTURING COMPANY . CANTON
UNION SWITCH & SIGNAL COMPANY . . SWISSVALE
UNITED AIRCRAFT CORPORATION . . EAST HARTFORD
UNITED-CARR FASTENER CORPORATION . CAMBRIDGE
UNITED CHROMIUM, INCORPORATED . . NEW YORK
UNITED ENGINEERING & FOUNDRY CO. . PITTSBURGH
UNITED METAL BOX COMPANY . . . . BROOKLYN
UNITED MOTORS SERVICE DIV., GMC . . DETROIT
UNITED SHOE MACHINERY CORPORATION . . BOSTON
UNITED SPECIALTIES COMPANY . . . . CHICAGO
UNITED STATES PIPE AND FOUNDRY CO. BURLINGTON
UNITED STATES RUBBER COMPANY . . . NEW YORK
UNITED STATES SPRING & BUMPER CO. . LOS ANGELES
UNITED STATES STEEL CORPORATION OF DELAWARE . . . . . PITTSBURGH
UNITED STATES STEEL SUPPLY COMPANY . . CHICAGO
UNITED TRANSPORTS, INC. . . . . OKLAHOMA CITY

VAN DORN IRON WORKS COMPANY . . CLEVELAND
VANCE COMPANY, J. A. . . . . WINSTON-SALEM
VEEDER-ROOT, INC. . . . . HARTFORD
VERSON ALLSTEEL PRESS COMPANY . . . CHICAGO
VICKERS, INC. . . . . DETROIT
VICTOR ADDING MACHINE COMPANY . . . CHICAGO
VICTOR MANUFACTURING & GASKET CO. . . CHICAGO
VICTORY PLASTICS COMPANY . . . . . HUDSON
VIKING TOOL & MACHINE CORPORATION . BELLEVILLE
VISKING CORPORATION . . . . . CHICAGO
V-M CORPORATION . . . . . BENTON HARBOR

WAGNER ELECTRIC CORPORATION . . . ST. LOUIS
WAGNER MALLEABLE IRON COMPANY . . . DECATUR
WALTERS MANUFACTURING COMPANY . . OAKMONT
WALWORTH COMPANY . . . . . NEW YORK
WALZ & KRENZER, INC. . . . . ROCHESTER
WARD LAFRANCE TRUCK CORPORATION . . ELMIRA
WARNER ELECTRIC BRAKE MANUFACTURING CO. BELOIT
WARNER & SWASEY COMPANY . . . . CLEVELAND
WARREN WEBSTER & COMPANY . . . . CAMDEN
WATERBURY COMPANIES . . . . . WATERBURY
WATERBURY FARRELL FOUNDRY & MACHINE COMPANY . . . . . WATERBURY
WAUKESHA MOTOR COMPANY . . . . WAUKESHA
WEATHERHEAD COMPANY . . . . . CLEVELAND
WEBB COMPANY, JERVIS B. . . . . DETROIT
WEIRTON STEEL COMPANY . . . . . WEIRTON
WELDING ENGINEERS, INC. . . . . NORRISTOWN
WEST BEND ALUMINUM COMPANY . . . WEST BEND
WEST POINT MANUFACTURING COMPANY . . BOSTON
WEST TIRE SETTER COMPANY . . . . ROCHESTER
WESTERN ELECTRIC COMPANY . . . . NEW YORK
WESTERN FELT WORKS . . . . . CHICAGO
WESTERN METALCRAFT, INC. . . . . OLYMPIA
WESTINGHOUSE AIR BRAKE COMPANY . . WILMERDING
WESTINGHOUSE ELECTRIC CORPORATION . PITTSBURGH
WETTLAUFER MANUFACTURING CORPORATION DETROIT
WHEELING STEEL CORPORATION . . . WHEELING
WHEELOCK COMPANY, GEO. F. . . . . BIRMINGHAM
WHITE MOTOR COMPANY . . . . . CLEVELAND
WHITE SEWING MACHINE CORPORATION . CLEVELAND
WHITIN MACHINE WORKS . . . . WHITINSVILLE
WIEGAND COMPANY, EDWIN L. . . . . PITTSBURGH
WILLARD STORAGE BATTERY COMPANY . CLEVELAND
WILLOUGHBY CHEVROLET COMPANY . . RICHMOND
WILLYS-OVERLAND MOTORS, INC. . . . . TOLEDO
WINCHESTER REPEATING ARMS COMPANY . NEW HAVEN
WINTER-WEISS COMPANY . . . . . DENVER
WIPING MATERIALS, INC. . . . . ST. LOUIS
WIREMOLD COMPANY . . . . . HARTFORD
WISCONSIN MOTOR CORPORATION . . . MILWAUKEE
WOLFE, HARRY M. . . . . CHICAGO
WOLVERINE FABRICATING & MANUFACTURING COMPANY . . . . . INKSTER
WOLVERINE TUBE DIVISION, CALUMET & HECLA CONSOLIDATED COPPER COMPANY . . . DETROIT
WOOD COMPANY, R. D. . . . . PHILADELPHIA
WOOD MANUFACTURING CO., JOHN . CONSHOHOCKEN
WOOD-MOSAIC COMPANY . . . . . LOUISVILLE
WORCESTER STAMPED METAL COMPANY . WORCESTER
WORDEN-ALLEN COMPANY . . . . . MILWAUKEE
WORLD STEEL PRODUCTS CORPORATION . NEW YORK
WORTHINGTON PUMP & MACHINERY CORPORATION . . . . . HARRISON
WROUGHT IRON RANGE COMPANY . . . ST. LOUIS
WYANDOTTE CHEMICALS CORPORATION . WYANDOTTE
WYCKOFF STEEL COMPANY . . . . . PITTSBURGH
WYSONG & MILES COMPANY . . . GREENSBORO

YORK CORPORATION . . . . . YORK
YOUNG RADIATOR COMPANY . . . . . RACINE
YOUNG SPRING & WIRE CORPORATION, L. A. . DETROIT
YOUNGSTOWN SHEET & TUBE COMPANY YOUNGSTOWN

ZIM MANUFACTURING COMPANY . . . . CHICAGO